This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

NYPL RESEARCH LIBRARIES
3 3433 06909135 7

THE

PACKARD

COMMERCIAL ARITHMETIC.

BY

S. S. PACKARD,

PRESIDENT OF PACKARD'S BUSINESS COLLEGE, NEW YORK, AUTHOR OF THE BRYANT AND STRATTON BOOK-KEEPING SERIES, AND OF PACKARD'S COMPLETE COURSE OF BUSINESS TRAINING,

AND

BYRON HORTON, A.M.,

PRINCIPAL OF THE MATHEMATICAL DEPARTMENT OF PACKARD'S BUSINESS COLLEGE.

FOURTEENTH EDITION.

NEW YORK:
S. S. PACKARD, 805 BROADWAY.
1885.

34678A

THE PACKARD COMMERCIAL ARITHMETIC

COMPLETE EDITION, 328 Pages, Octavo.

SCHOOL EDITION, 276 Pages, 12mo.

KEY TO COMPLETE EDITION (For Teachers), $1.00.

KEY TO SCHOOL EDITION—In Preparation.

The complete edition is published both with and without answers. Unle otherwise ordered, books with answers will be sent.

PACKARD'S
NEW MANUAL OF BOOK-KEEPING AND CORRESPONDENCE.
CLOTH, 160 Pages, Octavo.

A most lucid and practical presentment of the subjects of Accounts a Business Correspondence.

Copyright, 1882,
By S. S. PACKARD and BYRON HORTON.

Electrotyped by
Smith & McDougal.

Printed by
Russell Brothe

PREFACE.

THE question as to whether a new Commercial Arithmetic was called for, is answered in the ready sale which has attended the publication of this volume. It does not necessarily argue that other arithmetics have failed to meet a large popular demand, or that those who use them are dissatisfied with them. It simply emphasizes the fact that what may suit one intelligent teacher will not, for that reason alone, suit another; and nothing could make this point clearer than to state, what is really true, that all the Commercial Arithmetics that have appeared during the past ten years have been prepared by active teachers, who required certain things in their own work not to be found in existing books. There are few, if any, text books that could not, in some respects, be changed to advantage by those who use them; and the main reason why there are not fifty text books where there is but one is a reason of economy, rather than of inability of teachers to prepare their own books, or even of entire satisfaction with the books in use.

It is worthy of notice that, in the line of commercial text books particularly, there is a growing tendency to authorship on the part of wide awake teachers; so much so that there are to-day twenty treatises on book-keeping where there was one twenty years ago; and in the line of commercial mathematics, commercial law and practical grammar, one can safely calculate on a new book every six months. Nobody has a right to complain of this tendency. It should, in fact, give great satisfaction to all who are interested in practical education; for it not only speaks of the growing energy and intelligence of the teachers who have this education in charge, but especially of the appreciation of the public, through whose encouragement alone such worthy ambition can be gratified.

The authors of this book do not claim to have discovered, all at once, that nobody hitherto has had the ability to prepare an arithmetic, or that it was impossible longer to utilize the books that have served the purposes of the past. They do not even claim that their book is better, or worse, than any or all of its predecessors; they claim only that it is different from any of them, and in this difference lies their only excuse for its appearance. The book was written to supply a known want in a single school, with the feeling, also, that other schools, having felt a similar want, might find it met, in some measure, through the efforts here put forth. In fact, a large number of teachers have already expressed such satisfaction in a practical way, and there are doubtless others, on the point of issuing their own books, who, upon a close examination of this, will find it so well suited to their purpose that they will be induced to lay aside for a time their unfinished manuscript, and possibly to defer publication indefinitely. There is no desire on the part of the authors of this book to discourage the publication of new arithmetics; but they are quite willing to do what lies in their power, in connection with their fellow-authors already in the field, to satisfy teachers so fully that they will find no good excuse for diverting their energies from the great work of oral instruction, but will seek rather to give to it new zest, with the consciousness that others are both willing and able to relieve them from the irksomeness and risk of book-making.

It is not deemed necessary to point out with particularity the peculiar merits or demerits of the book. Both will be readily discerned by those who use it, and those who do not use it will care very little about them. We will only say that it is not a rehash of any book or books that have gone before it, and that in not a single instance have the authors relied for their statistics, their statements of local laws and customs, or any of their facts, upon other authors, either of the present or the past, but have uniformly obtained their information from the highest authentic sources. And, moreover, they propose to keep open these avenues of information, and to revise all future editions closely in reference to any changes that may occur.

It is but justice to say that the main work of authorship has been done by the one whose name stands second on the title page, which renders it possible to add that it has been conscientiously and faithfully done.

NEW YORK, *October* 2, 1882.

CONTENTS.

PAGE
PROPERTIES OF NUMBERS 1
    Prime Factors 3
    Common Divisors 4
    Common Multiples 6
    Cancellation 8
REVIEW EXAMPLES 11
FRACTIONS 14
    Reduction 16
    Addition 20
    Subtraction 22
    Multiplication 23
    Division 27
REVIEW EXAMPLES 32
DECIMALS 36
    Reduction 40
    Addition 41
    Subtraction 43
    Multiplication 44
    Division 45
REVIEW EXAMPLES 46
DENOMINATE NUMBERS 49
    Divisions of Time 49
    Linear Measures 51
    Square Measures 52
    Cubic Measure 54
    Liquid Measures 56
    Dry Measure 56
    Measures of Weight 57
    Circular Measure 59
    United States Money 60
    English Money 63
    Foreign Moneys of Account 64
    Reduction of Denominate Integers 65
    Reduction of Denominate Fractions 67
    Addition 71
    Subtraction 72
    Multiplication 74
    Division 75
    Longitude and Time 75
THE METRIC SYSTEM 77
    Linear Measure 78
    Square Measure 79
    Cubic Measure 80
    Dry and Liquid Measure 81
    Weight 82
    Table of Equivalents 84
    Approximate Rules 85
FOREIGN WEIGHTS AND MEASURES 88

PAGE
REVIEW EXAMPLES . . . [illegible]
PERCENTAGE . . . [illegible]
DISCOUNTS . . . [illegible]
BILLS . . . [illegible]
COMMISSION AND BROKERAGE . . . [illegible]
PROFIT AND LOSS . . . [illegible]
INTEREST . . . [illegible]
 Accurate Interest . . . [illegible]
PROBLEMS IN INTEREST . . . [illegible]
 To find the Rate . . . [illegible]
 To find the Time . . . [illegible]
 To find the Principal, the Interest, Time, and Rate being given . . . [illegible]
 To find the Principal, the Amount, Time, and Rate being given . . . [illegible]
PRESENT WORTH AND TRUE DISCOUNT . . . [illegible]
REVIEW EXAMPLES . . . [illegible]
ANNUAL INTEREST . . . [illegible]
COMPOUND INTEREST . . . [illegible]
COMMERCIAL PAPER . . . [illegible]
BANK DISCOUNT . . . [illegible]
PARTIAL PAYMENTS . . . [illegible]
 United States Rule . . . [illegible]
 Mercantile Rules . . . [illegible]
 Connecticut Rule . . . [illegible]
 New Hampshire Rule . . . [illegible]
 Vermont Rule . . . [illegible]
RATIO AND PROPORTION . . . [illegible]
INSURANCE . . . [illegible]
 Fire Insurance . . . [illegible]
 Marine Insurance . . . [illegible]
EXCHANGE . . . 174
 Domestic Exchange . . . 175
 Foreign Exchange . . . [illegible]
EQUATION OF ACCOUNTS . . . 187
 When the items are all debits or all credits . . . 187
 When the account contains both debit and credit items . . . [illegible]
 Equation of Accounts Sales . . . [illegible]
ACCOUNTS CURRENT . . . [illegible]
STOCKS AND BONDS . . . 216
 Government Bonds . . . 218
 New York Stock Exchange . . . 221
TAXES . . . 225
DUTIES . . . 238
PARTNERSHIP . . . 249
NATIONAL BANKS . . . 264
SAVINGS BANKS . . . 269
LIFE INSURANCE . . . 273
GENERAL AVERAGE . . . 280
CLEARING HOUSES . . . 285
DETECTION OF ERRORS IN TRIAL BALANCES . . . 290
REVIEW EXAMPLES . . . 291
APPENDIX . . . 296
 Drill Exercises . . . 296
 Short Method [illegible] Account . . . 298
 Short Methods [illegible] . . . 299
 Short Methods [illegible] . . . 310
 Explanatory Notes . . . 312

COMMERCIAL ARITHMETIC.

PROPERTIES OF NUMBERS.

DEFINITIONS.

1. A **Unit,** or **Unity,** is one, or a single thing; as *one, one* foot, *one* dollar.

2. A **Number** is a unit, or a collection of units; as *one, four, three* feet, *five* dollars.

3. All numbers are either *integral* or *fractional, abstract* or *concrete.*

4. An **Integral Number,** or **Integer** is a number which expresses whole things; as *two, four* gallons, *seven* dollars.

5. A **Fractional Number,** or **Fraction** is a number which expresses one or more equal parts of a unit; as *one-half, three-fourths.*

6. An **Abstract Number** is a number which does not refer to any particular object; as *one, six, ten.*

7. A **Concrete Number** is a number applied to an object, or quantity; as *three* apples, *five* pounds, *ten* dollars.

8. Integral numbers are either *odd* or *even, prime* or *composite.*

9. An **Odd Number** is a number whose unit figure is 1, 3, 5, 7, or 9; as 7, 21, 39.

PRIME FACTORS.

16. The **Factors** of a number are those numbers which multiplied together will produce the number.

Thus 4 and 7; 2 and 14; 2, 2, and 7 are factors of 28. The number itself and unity are not regarded as factors.

The *factors* of a number are also the *exact divisors* of it.

17. A **Prime Factor** is a prime number used as a factor.

Thus, 2, 2, and 7 are the prime factors of 28. 4 is a factor of 28, but not a *prime* factor.

18. To find all the prime factors of a composite number.

Ex. What are the prime factors of 6930.

OPERATION.

2) 6930
3) 3465
3) 1155
5) 385
7) 77
11

ANALYSIS.—Any prime number that is an exact divisor of the given number is a prime factor of it. Divide the given number by 2 (**15**, 1), the least prime divisor of it, obtaining the quotient 3465. Next, divide this quotient successively by 3 (**15**, 2), 3, 5 (**15**, 4), and 7. The last quotient 11 is a prime number and therefore a prime factor. The several divisors 2, 3, 3, 5, 7 and the last quotient 11 are the prime factors required.

$$2 \times 3 \times 3 \times 5 \times 7 \times 11 = 6930.$$

19. RULE.—*Divide by the least prime number which will divide the given number without a remainder. In like manner divide the resulting quotient, and continue the division until the quotient is a prime number. The several divisors and the last quotient are the prime factors.*

EXAMPLES.

20. Resolve the following numbers into their prime factors:

1. 3465.
2. 3003.
3. 4158.
4. 3150.
5. 3675.
6. 2310.
7. 6552.
8. 7826.
9. 6006.
10. 5368.
11. 3825.
12. 5324.
13. 8192.
14. 6561.
15. 3125.
16. 1800.
17. 1935.
18. 2475.
19. 6660.
20. 2448.
21. 8525.
22. 9936.
23. 9576.
24. 5075.

COMMON DIVISORS.

21. A **Common Divisor, or Common Measure,** of two or more numbers is any number that will divide each without a remainder; hence it is a common factor of each of them.

22. The **Greatest Common Divisor** of two or more numbers is the *greatest* number that will divide each without a remainder; hence it is their greatest common factor.

Thus, 2, 3, 4, and 12 are common divisors of 36, 48, and 60; 12 is their greatest common divisor.

23. PRINCIPLE.—*The greatest common divisor of two or more numbers is the product of all their common prime factors.*

24. To find the greatest common divisor of two or more numbers.

Ex. What is the greatest common divisor of 168, 252, and 420?

FIRST OPERATION.

$$\begin{aligned} 168 &= \overset{*}{2}\times\overset{*}{2}\times 2\times\overset{*}{3}\times\overset{*}{7} \\ 252 &= \overset{*}{2}\times\overset{*}{2}\times\overset{*}{3}\times 3\times\overset{*}{7} \\ 420 &= \overset{*}{2}\times\overset{*}{2}\times\overset{*}{3}\times 5\times\overset{*}{7} \end{aligned}$$

$$2\times 2\times 3\times 7 = 84.$$

ANALYSIS.—Resolve the numbers into their prime factors. The product, 84, of the common factors 2, 2, 3, and 7 is the greatest common divisor. (*Prin.*)

SECOND OPERATION.

$$\begin{array}{r} 4\,)\,\underline{168,\ \ 252,\ \ 420} \\ 7\,)\,\underline{42,\ \ \ 63,\ \ 105} \\ 3\,)\,\underline{6,\ \ \ \ 9,\ \ \ 15} \\ 2,\ \ \ \ 3,\ \ \ \ \ 5 \end{array}$$

$$4\times 7\times 3 = 84.$$

ANALYSIS.—Divide the given numbers by any number that will divide them all without a remainder, and divide the quotients in the same manner until the last quotients have no common divisor. Since 4 will divide all the given numbers, and 3 and 7 will divide successively the resulting quotients, their product, 84, is a common divisor of the given numbers. Since the last quotients have no common divisor or factor, 84 is the *greatest* common divisor.

25. RULE.—*Resolve the numbers into their prime factors. The product of the factors common to all the numbers will be the greatest common divisor.* Or,

Divide the given numbers by any factor that will divide all of them without a remainder. In like manner divide *the resulting quotients, and continue the division until the quotients have no common factor. The product of the several divisors will be the greatest common divisor.*

EXAMPLES.

26. Find the greatest common divisor of the following numbers:

1. 24, 36, and 48.
2. 35, 56, and 70.
3. 42, 56, and 28.
4. 30, 60, and 75.
5. 64, 96, and 128.
6. 66, 198, and 330.
7. 90, 150, and 210.
8. 84, 420, and 126.
9. 108, 144, and 360.
10. 144, 336, and 240.
11. 165, 550, and 220.
12. 792, 144, and 216.
13. 405, 243, and 324.
14. 378, 126, and 252.
15. 375, 625, and 250.
16. 288, 720, and 864.

27. To find the greatest common divisor of two numbers when they are not readily factored.

28. PRINCIPLES.—1. *If the smaller of two numbers is a divisor of the greater, it is their greatest common divisor.*

2. *A common divisor of two numbers is a divisor of their sum, and also of their difference.*

3. *A divisor of a number is a divisor of any multiple of that number.*

29. RULE.—*Divide the greater number by the smaller, and divide the last divisor by the remainder; and so continue until there is no remainder. The last divisor will be the greatest common divisor.*

NOTES.—1. When the greatest common divisor of more than two numbers is required, find the greatest common divisor of the smallest two first, and of this greatest common divisor and the next greater, and so on, until all the numbers are used. The last divisor will be the greatest common divisor of all the given numbers.

2. If, at any step in the process, a prime factor appear that is not common to all the numbers, it may be rejected. (See second operation of example.)

3. If the remainder at any time is a prime number, and it is not contained in the last divisor, there is no common divisor greater than 1; it will therefore be useless to further continue the division.

Ex. Find the greatest common divisor of 391 and 437.

OPERATIONS.

```
391)437(1
    391                         Or,
    ---
     46)391(8              2)46
        368                  --
        ---               23)391(17
         23)46(2             23
            46               ---
            --               161
             0               161
                             ---
                               0
```

DEMONSTRATION. — Since 23 is a divisor of 46, it is a divisor of 368, a multiple of 46 (*Prin.* 3). Since 23 is a divisor of itself and 368, it is a divisor of their sum, 391 (*Prin.* 2). Since 23 is a divisor of 46 and 391, it is a divisor of their sum, 437. 23 is therefore a *common divisor* of 391 and 437, the given numbers.

The greatest common divisor of 391 and 437, whatever it may be, is a divisor of their difference, 46 (*Prin.* 2); also of 368, a multiple of 46 (*Prin.* 3); also of 23, 391 − 368 (*Prin.* 2). Since the divisor of a number cannot be greater than itself, the greatest common divisor of the given numbers cannot be greater than 23. 23 is therefore the *greatest common divisor.*

30. Find the greatest common divisor of the following numbers:

1. 319 and 377.
2. 259 and 629.
3. 589 and 713.
4. 903 and 989.
5. 611, 799, and 987.
6. 744, 984, and 522.
7. 391, 667, and 920.
8. 451, 481, and 737.
9. 504, 756, and 252.
10. 425, 748, and 561.

COMMON MULTIPLES.

31. A **Multiple** of a number is a number that is exactly divisible by it; or, it is any product of which the given number is a factor.

32. A **Common Multiple** of two or more numbers is a number that is exactly divisible by each of them.

33. The **Least Common Multiple** of two or more numbers is the *least* number that is exactly divisible by each of them.

Thus, 12, 24, 36, and 48 are common multiples of 4 and 6; 12 is their least common multiple.

34. PRINCIPLES.—1. *A multiple of a number contains all the prime factors of that number.*

2. *A common multiple of two or more numbers contains all the prime factors of each of those numbers.*

3. *The least common multiple of two or more numbers contains all the prime factors of each of the numbers, and no other factors.*

35. To find the least common multiple of two or more numbers.

Ex. What is the least common multiple of 12, 18, 20, and 40?

FIRST OPERATION.

$$\begin{aligned} 12 &= 2\times2\times3 \\ 18 &= 2\times3\times3 \\ 40 &= 2\times2\times2\times5 \end{aligned}$$

$$2\times2\times2\times3\times3\times5 = 360$$

ANALYSIS.—Since 40, a multiple of 20, contains all the prime factors of 20, the number 20 may be omitted in the operation. Resolve the numbers into their prime factors. The least common multiple must contain 2 as a factor 3 times in order to be divisible by 40; it must contain 3 as a factor twice in order to be divisible by 18; and it must contain 5 as a factor, in order to be divisible by 40. 360, the product of the factors 2, 2, 2, 3, 3, and 5, is the least common multiple of the given numbers, since it contains the different factors the greatest number of times that they occur in the given numbers, and no other factors (*Prin.* 3).

SECOND OPERATION.

$$\begin{array}{r|rrr} 2 & 12, & 18, & 40 \\ \hline 2 & 6, & 9, & 20 \\ \hline 3 & 3, & 9, & 10 \\ \hline & 1, & 3, & 10 \end{array}$$

$$2\times2\times3\times3\times10 = 360$$

ANALYSIS.—The factors of the required multiple may be selected by the following process. Divide the given numbers by any prime number that will divide two or more of them, writing the quotients and the undivided numbers beneath. Treat the resulting numbers in like manner, and continue the process until no two of the numbers have a common factor or divisor. The product of the several divisors and the remaining quotients and undivided numbers will be the least common multiple.

36. RULE.—*Resolve the given numbers into their prime factors. The product of the different prime factors, taking each factor the greatest number of times it appears in any of the numbers, will be the least common multiple.* Or,

[illegible]

... of the following numbers

15. [illegible]

16. [illegible]

17. [illegible] and 24.

18. 24, [illegible], and 40.

19. 32, 48, and 72.

20. [illegible], 22, and 24.

21. [illegible], and 30.

22. 12, 16, and 20.

23. 33, 44, and 55.

24. [illegible], and 42.

25. 30, 45, and 60.

26. 28, 35, and 42.

27. 45, 55, and 60.

28. 60, 72, and 84.

CANCELLATION.

58. [illegible] of shortening an operation [illegible] dividend and divisor.

59. [illegible] *Cancelling or rejecting a factor from a* [illegible] *that factor* [illegible] *and divisor by the same number does* [illegible] *quotient.*

Ex. Divide 84 × 36 by 27 × 14.

OPERATIONS.

$$\frac{\overset{\overset{2}{\cancel{6}}}{\cancel{84}} \times \overset{4}{\cancel{36}}}{\underset{\cancel{3}}{\cancel{27}} \times \cancel{14}} = 8$$

Or,

$$\begin{array}{r|l} \cancel{3}\ \cancel{27} & \cancel{84}\ \cancel{6}\ 2 \\ \cancel{14} & \cancel{36}\ 4 \\ \hline & 8 \end{array}$$

ANALYSIS.—Indicate the operations to be performed as in the margin. It is seen by inspection that 36 and 27 contain the common factor 9; therefore cancel or reject it from both, retaining the factors 4 and 3 respectively. 14 and 84 contain the common factor 14; therefore reject it, retaining the factor 6 in the dividend. [Since cancellation is a process of division, the rejecting of 14 does not destroy it, but divides it, leaving 1 as a quotient. It is unnecessary to write 1 as a quotient, except when there are no other factors in the dividend.] 3 is a common factor of 6 and 3; therefore reject it from both, retaining the factor 2 in the dividend. The product of the remaining factors, 2 and 4, is the required quotient.

40. RULE.—*Indicate the operations to be performed by writing the numbers denoting multiplication above a horizontal line, and the numbers denoting division below. The numbers above the line will form a dividend, and the numbers below a divisor. Cancel or reject the factors common to both dividend and divisor. The product of the remaining factors of the dividend divided by the product of the remaining factors of the divisor will be the required quotient.*

EXAMPLES.

41. *1.* Divide 27 × 48 × 60 by 54 × 36 × 40.

What is the value of the following expressions:

2. $\frac{40 \times 36 \times 42 \times 18}{9 \times 35 \times 30 \times 8}$.

3. $\frac{24 \times 30 \times 54 \times 35}{14 \times 15 \times 21 \times 64}$.

4. $\frac{360 \times 28 \times 27 \times 5}{25 \times 42 \times 18 \times 12}$.

5. $\frac{17 \times 36 \times 25 \times 144}{48 \times 60 \times 108 \times 51}$.

6. $\frac{1760 \times 175 \times 6}{4 \times 9 \times 100 \times 10}$.

7. $\frac{1760 \times 6 \times 145}{100 \times 365}$.

8. $\frac{1500 \times 144 \times 5}{365 \times 100}$.

9. $\frac{144 \times 625 \times 37 \times 12}{288 \times 375 \times 185}$.

10. Multiply 72 by 3 × 18, divide the product by 8 times 9, multiply the quotient by 7 × 20, divide the product by 360, multiply the quotient by 6 times 8.

2345
4321

ns of coal cost $147, what will 16 tons cost ?

gave 9 pounds of butter at 17 cents a pound for
nolasses; how much was the molasses worth a

If 20 pounds of beef cost 250 cents, what cost 75 pounds ?

How many potatoes at 65 cents per bushel will pay for
s' board at $7.50 per week ?

A merchant bought 375 barrels of flour at $5.50 per barrel,
id in cloth at $2.75 per yard; how many yards did it
?

6. How many pounds of coffee at 27 cents per pound should be given for 57 bushels of corn at 63 cents per bushel ?

17. Sold 28 bushels of apples for $21; what should I receive for 42 bushels ?

18. How many cows worth $35 each must be given in exchange for 84 tons of hay at $15 per ton ?

19. How many bushels of corn at 52 cents a bushel must be exchanged for 324 bushels of oats at 39 cents per bushel ?

20. If 430 bushels of wheat are obtained from sowing 7 bushels, how much would be obtained from sowing 21 bushels ?

21. What should be paid for the transportation of 3600 pounds of cheese at the rate of 47 cents per 100 pounds ?

22. What must be paid for transporting 31600 pounds of iron at $5 per ton of 2000 pounds ?

23. What will 7840 pounds of coal cost, at $6 per ton of 2240 pounds ?

24. If 3 men eat 7 pounds of meat in one week, how much would 6 men eat in 4 weeks ?

25. How many canisters, each holding 40 ounces, can be filled from 3 chests of tea, each containing 55 pounds of 16 ounces ?

26. How many times can 16 bottles, each holding 3 pints, be filled from 6 demijohns, each containing 10 gallons of 8 pints each ?

27. A man exchanged 275 barrels of potatoes, each containing 3 bushels, at 54 cents per bushel, for a certain number of pieces of muslin each containing 45 yards, at 11 cents per yard. How many yards did he receive ?

28. If a person travel 24 hours each day at the rate of 45 miles an hour, how many days would it require to pass around the globe, a distance of 25000 miles ?

REVIEW EXAMPLES.

42. *1.* Write in figures each of the following numbers, add them, and express in words (or numerate) their sum : Forty-five thousand and forty-five; sixteen thousand three hundred and sixty; one hundred and sixty-seven thousand; eight hundred and fifty thousand and ninety-two; nine million and twenty-four.

2. Subtract eight hundred and fourteen thousand nine hundred and sixteen from four million and nineteen thousand.

3. Multiply five hundred and sixty thousand seven hundred and eight by eighteen hundred and sixty.

4. A quantity of merchandise was bought for $27618.75, and sold for $32418.25. What was the gain?

5. What is the sum of 2817, 273, 30006, 97, 7285, 2700576, 7000781, 27 ?

6. If I sell goods for $23876, and gain $5389, what did the goods cost me?

7. What is the sum of the prime numbers from 20 to 50?

Add the following numbers as they stand, from left to right, and from right to left. [In making out bills, and in other commercial operations, a great deal of time can be saved by adding in this manner, without re-arranging the numbers.]

8. 17, 27, 36, 14, 43, 42, 65, 73, 81, 35.

9. 137, 414, 528, 345, 678, 975, 864, 357, 121, 234.

10. 67.16, 5.12, 3.75, 475, 38.42, 59.27, 38.75, 175.25.

11. 2345, 16, 375, 4218, 376, 7, 8475, 247, 39.

12. 1234.27, 348.25, 775, 7.16, 89.76, 374.12, 5673.56, 397.23.

Find the difference between the numbers in each of the following groups. [In all of these cases the subtrahend is placed above the minuend, the purpose being to give the student practice in subtracting *downward* rather than upward, as the general custom is. It is often requisite in business to perform the work in this way, and the accountant should practice both methods.]

(*13.*)	(*14.*)	(*15.*)	(*16.*)	(*17.*)
76534	19827	26347	72016	12345
81279	84362	71356	99385	54321

[illegible] What

[illegible] divided by

[illegible] divide

[illegible] what is the

[illegible] how many acres can be

[illegible] common multiple of the nine digits?

[illegible] what will 54 head cost?

[illegible] flour for [illegible] which was

[illegible] What did it cost him a barrel?

[illegible] that will exactly divide each

[illegible]

[illegible] of money with which horses can

[illegible] $50 each, or sheep at $5 each, using

[illegible]?

[illegible] yards of cloth at 79 cts. per yard:

[illegible] per yard, and the remainder at 97 cts

[illegible] of the day, $6492.75: cash

[illegible] Required the

[illegible] contains [illegible]

36. There are five bidders to supply the government with 800 tons Lehigh, 500 tons Cumberland, and 700 tons Baltimore coal. A offers Lehigh at \$6.29, Cumberland at \$4.38, and Baltimore at \$7.23. B offers Lehigh at \$6.80, Cumberland at \$4.12, and Baltimore at \$7.24. C offers Lehigh at \$6.40, Cumberland at \$4.45, and Baltimore at \$7.18. D offers Lehigh at \$6.17, Cumberland at \$4.19, Baltimore at \$7.20. E offers Lehigh at \$6.50, Cumberland at \$4.33, and Baltimore at \$7.25. Who is the lowest bidder for the whole amount, and how much does each bid amount to?

37. A drover bought a number of cattle for \$12204, and sold the same for \$13560, by which he gained \$4 per head. How many cattle were purchased?

38. A farmer raised in one year 512 bushels of wheat, the next year twice as much as he raised the first year, and the third year four times as much as he did the second year. What was the value of the three crops at \$1.65 per bushel?

39. How many pounds of tea at 78 cts. per pound must be given for 375 bushels of wheat at \$1.56 per bushel?

40. Bought 75 tons of hay at \$16 per ton; gave in payment 56 sheep at \$3.75 each, and the remainder I paid in butter at 33 cts. per pound. How many pounds of butter were required?

41. Bought 225 acres of land for \$12600, and sold 116 acres at \$65 per acre, and the remainder at cost; how much did I gain?

42. The estimated number of bushels of corn produced in the United States in 1877 was 1,342,558,000, the total value of crop was \$480,643,400, and the total area of crop was 50,369,113 acres. What was the average value per bushel, and average value of yield per acre?

43. In 1878 there were 39258 postmasters in the United States, and their total salaries were \$7,977,852; what was the average salary paid?

44. July 1, 1866, the public debt of the United States was \$2,773,236,173, and May 1, 1880, \$1,968,314,753; what was the average monthly decrease?

45. A sold to B 175 acres of land at \$135 an acre, and by so doing gained \$1925; B sold the land at a loss of \$1750. What did A pay per acre, and what was B's selling-price per acre?

46. A merchant sold 800 barrels of flour for \$5867, 144 barrels of which he sold at \$7 per barrel, and 225 barrels at \$6.75. At how much per barrel did he sell the remainder?

[illegible]

[illegible]

[illegible] numbers. [illegible] fractions writt[illegible] Fractions.

[illegible] Denominator [illegible] parts.

[illegible] Numerator. [illegible] taken to form the

[illegible] taken together, are

50. A **Simple Fraction** is a single fraction, both of whose terms are integers.

51. Simple fractions are *proper* or *improper.*

52. A **Proper Fraction** is one that is less than a unit; the numerator being less than the denominator. Thus, $\frac{1}{2}$, $\frac{3}{4}$, and $\frac{7}{8}$ are proper fractions.

53. An **Improper Fraction** is one that is equal to, or greater than a unit; hence the numerator must be equal to, or greater than the denominator. Thus, $\frac{3}{2}$, $\frac{5}{4}$, $\frac{3}{3}$, and $\frac{11}{8}$ are improper fractions.

54. A **Mixed Number** is an integer and a fraction united; as $2\frac{1}{2}$, $4\frac{3}{4}$, $18\frac{7}{8}$.

55. A **Compound Fraction** is a fraction of a fraction; as $\frac{1}{2}$ of $\frac{3}{8}$, $\frac{4}{5}$ of $7\frac{1}{2}$; $\frac{2}{3}$ of $\frac{5}{6}$.

56. A **Complex Fraction** is one whose numerator is a fraction or mixed number; as $\frac{\frac{3}{4}}{3}$, $\frac{105\frac{2}{3}}{12}$, $\frac{75\frac{3}{4}}{16}$, $\frac{3\frac{2}{3}}{5}$, $\frac{12\frac{1}{2}}{15}$.

The expression $\frac{3\frac{3}{4}}{5\frac{1}{2}}$ indicates division, and is not properly a fraction. A unit cannot be divided into $5\frac{1}{2}$ equal parts.

57. PRINCIPLES.—1. *Multiplying the numerator or dividing the denominator by a number multiplies the fraction by that number.*

2. *Dividing the numerator or multiplying the denominator by a number divides the fraction by that number.*

3. *Multiplying or dividing both numerator and denominator by the same number does not change the value of the fraction.*

EXERCISES.

58. *1.* Read the following fractions, and copy separately: 1, the simple fractions; 2, the proper fractions; 3, the improper fractions; 4, the mixed numbers; 5, the compound fractions; 6, the complex fractions:

$\frac{13}{16}$; $4\frac{1}{4}$; $\frac{17}{4}$; $\frac{5}{10}$; $\frac{7}{8}$; $\frac{11}{5}$ of $\frac{10}{17}$; $175\frac{3}{4}$; $\frac{3\frac{3}{4}}{5}$; $\frac{7}{8}$ of $3\frac{1}{5}$, $13\frac{2}{3}$; $\frac{7}{9}$; $\frac{16}{15}$; $7\frac{3}{4}$; $8\frac{7}{9}$; $46\frac{3}{5}$; $\frac{141}{8}$; $\frac{18}{25}$; $\frac{14\frac{1}{2}}{20}$; $\frac{2}{3}$; $\frac{3}{4}$ of $\frac{8}{9}$.

[illegible] fractions: three fourths; seven eighths; [illegible] and one half; one hundred and three [illegible] and three thirty-seconds; forty-[illegible] tenths; nine forty-fifths; thirty-[illegible] forty-eighths.

[illegible] fractions: eight ninths; thirteen and [illegible] fourths; ten tenths; fourteen and [illegible] one hundred nineteenths; thirty-[illegible].

REDUCTION.

[illegible] of Fractions is the changing their form [illegible] value.

[illegible] reduced to *lower terms* when the numerator [illegible] are expressed in smaller numbers.

[illegible] in its *lowest terms* when its numerator and [illegible] common divisor.

[illegible] is reduced to *higher terms* when the numerator [illegible] are expressed in larger numbers.

[illegible] reduce a fraction to its lowest terms.

[illegible] to its lowest terms.

[illegible] **ANALYSIS.**—Dividing both terms of the fraction, [illegible], by the common divisor, 6, the result is [illegible]; dividing both terms of [illegible] by the common divisor, [illegible]. Since 2 and 3 have no common divisor, the fraction is [illegible] lowest terms (61).

[illegible] of the fraction has not been changed, because both terms have [illegible] by the same number (57, 8).

[illegible] result is often more readily obtained by dividing both terms by [illegible] common divisor.

[illegible] *Divide the terms of the fraction by any number that will divide both without a remainder, and continue the operation with the resulting fractions until they have no common divisor.* Or,

Divide the terms of the fraction by their greatest common divisor.

EXAMPLES.

65. Reduce to their lowest terms,

1. $\frac{32}{48}$.
2. $\frac{45}{60}$.
3. $\frac{48}{64}$.
4. $\frac{63}{81}$.
5. $\frac{72}{128}$.
6. $\frac{85}{105}$.
7. $\frac{90}{135}$.
8. $\frac{18}{144}$.
9. $\frac{96}{108}$.
10. $\frac{132}{168}$.
11. $\frac{105}{120}$.
12. $\frac{144}{180}$.
13. $\frac{1296}{1416}$.
14. $\frac{275}{625}$.
15. $\frac{528}{1760}$.
16. $\frac{512}{728}$.
17. $\frac{648}{1024}$.
18. $\frac{325}{750}$.
19. $\frac{375}{1000}$.
20. $\frac{625}{2000}$.
21. $\frac{86}{946}$.
22. $\frac{125}{625}$.
23. $\frac{125}{1000}$.
24. $\frac{6125}{10000}$.
25. $\frac{288}{512}$.
26. $\frac{1056}{1584}$.
27. $\frac{1136}{3088}$.
28. $\frac{1278}{3474}$.
29. $\frac{2688}{3072}$.
30. $\frac{1024}{1728}$.
31. $\frac{1001}{1144}$.
32. $\frac{1440}{1728}$.

66. To reduce a fraction to higher terms.

Ex. Reduce $\frac{3}{4}$ to a fraction whose denominator is 32.

OPERATION.

$32 \div 4 = 8$

$\frac{3}{4} = \frac{24}{32}$

ANALYSIS.—The fraction $\frac{3}{4}$ is reduced to *thirty-seconds*, without changing its value, by multiplying the terms by the number that will cause its denominator 4 to become 32 (**57**, 3). By dividing the required denominator 32 by the given denominator 4, this number is found to be 8. Multiplying both terms of $\frac{3}{4}$ by 8, the result is $\frac{24}{32}$.

67. RULE.—*Divide the required denominator by the denominator of the given fraction, and multiply both terms of the given fraction by the quotient.*

EXAMPLES.

68. *1.* Reduce $\frac{3}{4}$ to 48ths.

2. Change $\frac{7}{12}$ to an equivalent fraction having 60 for its denominator.

3. Reduce $\frac{2}{3}$, $\frac{5}{6}$, $\frac{9}{16}$ each to 48ths.
4. Reduce $\frac{5}{7}$, $\frac{3}{5}$, $\frac{21}{15}$ each to 105ths.
5. Reduce $\frac{11}{14}$, $\frac{5}{8}$, $\frac{1}{2}$ each to 56ths.
6. Reduce $\frac{7}{16}$, $\frac{11}{12}$, $\frac{19}{32}$ each to 96ths.
7. Reduce $\frac{7}{8}$, $\frac{8}{9}$, $\frac{3}{10}$ each to 360ths.
8. Reduce $\frac{17}{24}$, $\frac{5}{9}$, $\frac{11}{18}$ each to 72ds.
9. Reduce $\frac{4}{9}$, $\frac{20}{27}$, $\frac{17}{12}$ each to 108ths.
10. Reduce $\frac{5}{6}$, $\frac{3}{8}$, $\frac{11}{30}$ each to 360ths.

69. To reduce two or more fractions to equivalent fractions having their least common denominator.

70. A **Common Denominator** of two or more fractions is a denominator to which they can all be reduced, and is the common multiple of their denominators.

71. The **Least Common Denominator** of two or more fractions is the least denominator to which they can be reduced, and is the least common multiple of their denominators.

Ex. Reduce $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{6}$, $\frac{7}{10}$ to equivalent fractions having their least common denominator.

OPERATION.

$\frac{2}{3} = \frac{40}{60}$

$\frac{3}{4} = \frac{45}{60}$

$\frac{5}{6} = \frac{50}{60}$

$\frac{7}{10} = \frac{42}{60}$

$$2\,)\,\underline{3,\ 4,\ 6,\ 10}$$
$$\quad 2\quad 3\quad 5$$

$$2 \times 2 \times 3 \times 5 = 60$$

ANALYSIS.—The least common multiple of the denominators is found to be 60 (35), which we take as the least common denominator. By Art. 67, $\frac{2}{3}$ is reduced to $\frac{40}{60}$. We proceed in the same manner with each of the other fractions. The value of each fraction remains unchanged, since both terms have been multiplied by the same number. In many cases, the least common denominator can be readily found by inspection.

72. RULE.—*Find the least common multiple of the given denominators for the least common denominator, and reduce the given fractions to this denominator.*

EXAMPLES.

73. Reduce the following fractions to equivalent fractions having their least common denominator:

1. [illegible], $\frac{7}{10}$, $\frac{4}{15}$.
2. [illegible], [illegible], [illegible].
3. [illegible], [illegible], [illegible].
4. [illegible], [illegible], [illegible].
5. [illegible], [illegible], [illegible].
6. [illegible], $\frac{7}{15}$, [illegible].
7. [illegible], [illegible], [illegible].
8. [illegible], [illegible], $\frac{17}{[illegible]}$.
9. $\frac{17}{12}$, [illegible], [illegible].
10. $\frac{13}{20}$, $\frac{16}{25}$, $\frac{3}{10}$.
11. $\frac{13}{16}$, $\frac{17}{48}$, $\frac{47}{72}$.
12. $\frac{22}{45}$, $\frac{49}{75}$, $\frac{16}{25}$.

74. To reduce an integer or a mixed number to an improper fraction.

Ex. In 18 units, how many fourths?

OPERATION.

$$\begin{array}{l} 18 \\ \underline{\ \ 4} \\ 72 \text{ fourths.} \end{array}$$

Analysis.—In 1 there are 4 fourths ($\frac{4}{4}$), and in 18, eighteen times 4 fourths, or 72 fourths ($\frac{72}{4}$). Hence, $18 = \frac{72}{4}$.

Ex. Reduce $16\frac{7}{8}$ to an improper fraction.

OPERATION.

$$\begin{array}{l} 16\frac{7}{8} \\ \underline{\ \ \ 8} \\ 128 \text{ eighths.} \\ \underline{\ \ \ \ 7} \text{ eighths.} \\ 135 \text{ eighths.} \end{array}$$

Analysis.—In 1 there are 8 eighths ($\frac{8}{8}$), and in 16, sixteen times 8 eighths, or 128 eighths ($\frac{128}{8}$). 128 eighths and 7 eighths are 135 eighths. Hence, $16\frac{7}{8} = \frac{135}{8}$.

75. Rule.—*Multiply the integer by the required denominator, and to the product add the numerator of the fraction, and under the result write the denominator.*

Note.—When the numerator of the fraction is a small number, add it mentally to the product of the integer and the denominator.

EXAMPLES.

76. *1.* In 27, how many ninths?

2. Reduce $46\frac{1}{2}$ to halves.

3. How many eighths of a peck in $37\frac{7}{8}$ pecks?

Reduce the following to improper fractions :

4.	$37\frac{3}{4}$; $19\frac{7}{8}$; $208\frac{9}{16}$.	*9.*	$81\frac{2}{3}$; $196\frac{1}{2}$; $375\frac{3}{4}$.
5.	$56\frac{2}{3}$; $49\frac{5}{6}$; $182\frac{5}{7}$.	*10.*	$116\frac{11}{25}$; $456\frac{4}{11}$; $87\frac{13}{36}$.
6.	$375\frac{1}{2}$; $94\frac{9}{10}$; $46\frac{5}{8}$.	*11.*	$24\frac{3}{14}$; $179\frac{13}{16}$; $1767\frac{3}{4}$.
7.	$44\frac{3}{4}$; $37\frac{5}{12}$; $19\frac{13}{16}$.	*12.*	$87\frac{3}{8}$; $490\frac{5}{12}$; $168\frac{11}{18}$.
8.	$12\frac{1}{2}$; $48\frac{7}{20}$; $45\frac{5}{12}$.	*13.*	$384\frac{5}{8}$; $161\frac{3}{4}$; $175\frac{25}{32}$.

77. To reduce an improper fraction to an integer or a mixed number.

Ex. Reduce $\frac{27}{4}$ to a mixed number.

Analysis.—$1 = \frac{4}{4}$; hence in $\frac{27}{4}$, there are as many units as 4 fourths are contained times in 27 fourths, or $6\frac{3}{4}$.

78. Rule.—*Divide the numerator by the denominator.*

EXAMPLES.

79. *1.* Change [illegible] to a mixed **number.**

2. Reduce [illegible] of a dollar to dollars.

Reduce to integers or mixed numbers:

3. [illegible]; [illegible].
4. [illegible]; [illegible].
5. [illegible]; [illegible].
6. [illegible]; [illegible].
7. [illegible]; [illegible].
8. [illegible]; [illegible].
9. [illegible]; [illegible].
10. [illegible]; [illegible].
11. [illegible]; [illegible].
12. [illegible]; [illegible].
13. [illegible]; [illegible].
14. [illegible]; [illegible].

ADDITION.

80. Addition of Fractions is the process of finding the sum of two or more fractions.

81. PRINCIPLE.—*In order that fractions may be added, they must have like denominators and be parts of like units.*

Ex. What is the sum of $\frac{5}{12}$, $\frac{7}{12}$, and $\frac{3}{12}$?

OPERATION.

$$\tfrac{5}{12} + \tfrac{7}{12} + \tfrac{3}{12} = \tfrac{15}{12} = \tfrac{5}{4} = 1\tfrac{1}{4}$$

ANALYSIS.—As these fractions have a common denominator, we add their numerators, and write their sum, 15, over the common denominator, 12. $\frac{15}{12} = 1\frac{1}{4}$, the required result.

Ex. Add $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{5}{6}$.

OPERATION.

$$\tfrac{2}{3} + \tfrac{3}{4} + \tfrac{5}{6} = \frac{8 + 9 + 10}{12} = \tfrac{27}{12} = 2\tfrac{3}{12} = 2\tfrac{1}{4}.$$

ANALYSIS. Reduce the given fractions to equivalent fractions having the least common denominator, 12 (72). Then proceed as in previous example.

Ex. Find the sum of $29\frac{1}{6}$, $38\frac{3}{4}$, $17\frac{5}{8}$, and $42\frac{1}{3}$.

OPERATION.

$$\begin{array}{ll} 29\frac{1}{6} & \frac{4}{24} \\ 38\frac{3}{4} & \frac{18}{24} \\ 17\frac{5}{8} & \frac{15}{24} \\ 42\frac{1}{3} & \frac{8}{24} \\ 127\frac{7}{8} & \frac{45}{24} = 1\frac{7}{8} \end{array}$$

ANALYSIS.—The sum of the fractions is $\frac{45}{24} = 1\frac{7}{8}$, which added to the sum of the integers, gives $127\frac{7}{8}$, the required result.

Ex. How many yards in 12 pieces of prints containing 46^1, 48^2, 51^2, 49^3, 44^1, 48^2, 47^1, 49, 47^3, 50^3, 48^1, 48^2 yards respectively.

OPERATION.

46^1	47^1	
48^2	49	
51^2	47^3	
49^3	50^3	
44^1	48^1	
48^2	48^2	580^1.

ANALYSIS.—The sum of the fourths is $\frac{21}{4} = 5\frac{1}{4}$, which added to the sum of the integers gives $580\frac{1}{4}$, the total number of yards.

82. RULE.—*Reduce the given fractions to equivalent fractions having the least common denominator. Write the sum of the numerators over the common denominator, and reduce the resulting fraction to its simplest form.*

When there are mixed numbers or integers, add the integers and fractions separately, and then add the results.

EXAMPLES.

83. Add the following:

1. $\frac{5}{18}$, $\frac{11}{18}$, $\frac{7}{18}$, and $\frac{15}{18}$.

2. $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{6}$, and $\frac{7}{8}$.

3. $12\frac{1}{2}$, $7\frac{3}{8}$, $16\frac{9}{16}$, and $38\frac{3}{4}$.

4. $48\frac{4}{9}$, $46\frac{7}{18}$, $31\frac{2}{3}$, and $17\frac{1}{6}$.

5. $127\frac{7}{48}$, $\frac{23}{32}$, $175\frac{2}{3}$, and $\frac{5}{8}$.

6. $141\frac{9}{20}$, $197\frac{3}{4}$, and $43\frac{7}{12}$.

7. $75\frac{2}{5}$, $\frac{5}{9}$, $1028\frac{2}{3}$, and $\frac{13}{18}$.

8. $\frac{7}{8}$, $119\frac{1}{2}$, $240\frac{3}{4}$, and $17\frac{3}{16}$.

9. 46^1, 48^3, 40^2, 49, 47^3, and 46^2.

10. 40^3, 41^1, 48^2, 44^1, 49^3, 48^2, 49^3, 49^1, 47^3, 48^3, 48^3, and 49^1.

11. $18\frac{8}{9}$, $27\frac{1}{4}$, $42\frac{2}{3}$, and $51\frac{5}{6}$.

12. $146\frac{3}{4}$, $1\frac{4}{7}$, $53\frac{5}{14}$, and $68\frac{1}{2}$.

13. $1172\frac{5}{6}$, $19\frac{2}{3}$, $440\frac{7}{8}$, and $6\frac{3}{4}$.

14. $\frac{7}{16}$, $106\frac{5}{12}$, $37\frac{8}{9}$, and $7\frac{1}{6}$.

15. 175, $116\frac{7}{10}$, $143\frac{3}{5}$, and $27\frac{5}{7}$.

16. $20\frac{2}{3}$, $164\frac{3}{7}$, $\frac{11}{21}$, and $43\frac{5}{9}$.

17. $44\frac{1}{3}$, $16\frac{7}{8}$, $29\frac{7}{16}$, and $13\frac{3}{4}$.

18. 31^1, 48^3, 62^1, 19^3, 27^2, 48^1, and 37^3.

19. 61^3, 48^1, 47^3, 48, 48^2, 49^1, and 45^3.

20. $19\frac{3}{8}$, $444\frac{5}{16}$, $737\frac{1}{4}$, and $385\frac{1}{2}$.

SUBTRACTION.

84. Subtraction of Fractions is the process of finding the difference between two fractions.

85. PRINCIPLE.—*In order that fractions may be subtracted, they must have like denominators and be parts of like units.*

Ex. From $\frac{8}{9}$ take $\frac{5}{9}$.

OPERATION.

$$\tfrac{8}{9} - \tfrac{5}{9} = \tfrac{3}{9} = \tfrac{1}{3}$$

ANALYSIS.—As these fractions have a common denominator, we take the difference of the numerators, and place it over the common denominator. $\frac{3}{9} = \frac{1}{3}$ is the result required.

Ex. What is the difference between $\frac{3}{4}$ and $\frac{2}{3}$?

OPERATION.

$$\tfrac{3}{4} - \tfrac{2}{3} = \frac{9 - 8}{12} = \tfrac{1}{12}$$

ANALYSIS.—Reduce the given fractions to equivalent fractions having the least common denominator (**72**). Then proceed as in the previous example.

Ex. From $176\frac{3}{8}$ subtract $89\frac{3}{4}$.

OPERATION.

$$\begin{array}{rl} 176\tfrac{3}{8} & \quad \tfrac{3}{8} \\ 89\tfrac{3}{4} & \quad \tfrac{6}{8} \\ \hline 86\tfrac{5}{8} & \end{array}$$

ANALYSIS. $\frac{6}{8}$ from $\frac{3}{8}$ we cannot take; we therefore take $1 = \frac{8}{8}$ from 176, leaving 175. $\frac{8}{8} + \frac{3}{8} = \frac{11}{8}$. $\frac{11}{8} - \frac{6}{8} = \frac{5}{8}$. $175 - 89 = 86$. $86 + \frac{5}{8} = 86\frac{5}{8}$.

86. RULE.—*Reduce the given fractions to equivalent fractions having the least common denominator. Write the difference of the numerators over the common denominator, and reduce the resulting fraction to its simplest form.*

When there are mixed numbers, subtract the integers and fractions separately, and add the results.

EXAMPLES.

87. Find the difference between

1. $\frac{3}{4}$ and $\frac{5}{9}$.	*4.* $2\frac{1}{2}$ and $1\frac{9}{16}$.	*7.* $1\frac{1}{9}$ and $\frac{5}{6}$.
2. $\frac{7}{8}$ and $\frac{5}{12}$.	*5.* $\frac{7}{10}$ and $\frac{8}{15}$.	*8.* $\frac{5}{9}$ and $\frac{4}{11}$.
3. $\frac{2}{3}$ and $\frac{11}{24}$.	*6.* $\frac{5}{7}$ and $\frac{3}{5}$.	*9.* 1 and $\frac{11}{16}$.

10. $17\frac{1}{2}$ and $9\frac{1}{4}$.
11. $175\frac{1}{4}$ and $86\frac{1}{2}$.
12. $138\frac{2}{3}$ and $17\frac{1}{4}$.
13. $149\frac{1}{6}$ and $18\frac{5}{6}$.
14. $416\frac{7}{8}$ and $49\frac{3}{4}$.
15. $512\frac{3}{4}$ and $53\frac{7}{8}$.
16. 100 and $13\frac{3}{4}$.
17. $116\frac{5}{6}$ and $48\frac{2}{3}$.
18. $381\frac{2}{3}$ and $17\frac{3}{4}$.
19. $157\frac{5}{8}$ and $19\frac{3}{8}$.
20. 118^3 and 48^2.
21. $387\frac{3}{8}$ and $116\frac{3}{4}$.
22. $248\frac{5}{12}$ and $129\frac{1}{3}$.
23. $764\frac{3}{16}$ and $375\frac{1}{8}$.
24. $764\frac{1}{8}$ and $375\frac{3}{16}$.
25. $827\frac{1}{8}$ and $737\frac{2}{3}$.
26. $919\frac{3}{4}$ and $447\frac{5}{16}$.
27. 376^1 and 287^3.
28. 445^2 and 318^3.
29. 737^3 and 438^2.
30. 648^1 and 526^3.

MULTIPLICATION.

88. To multiply a fraction by an integer.

89. PRINCIPLE.—*Multiplying the numerator or dividing the denominator by a number multiplies the value of the fraction by that number* (**57**, 1).

Ex. What will 4 pounds of tea cost @ $\$\frac{7}{8}$ a pound?

OPERATIONS.

$$\frac{7}{8} \times 4 = \frac{7 \times 4}{8} = \frac{28}{8} = 3\frac{1}{2}$$

Or,

$$\frac{7}{8} \times 4 = \frac{7}{8 \div 4} = \frac{7}{2} = 3\frac{1}{2}$$

Or,

$$\frac{7}{\underset{2}{\cancel{8}}} \times \frac{\cancel{4}}{1} = \frac{7}{2} = 3\frac{1}{2}$$

ANALYSIS.—If 1 pound costs $\$\frac{7}{8}$, 4 pounds will cost 4 times $\$\frac{7}{8}$, or $\$\frac{28}{8}$, equal to $\$3\frac{1}{2}$. Hence, 4 pounds of tea @ $\$\frac{7}{8}$ will cost $\$3\frac{1}{2}$.

To multiply $\frac{7}{8}$ by 4, multiply the numerator 7 by 4, or divide the denominator 8 by 4; either operation will give $3\frac{1}{2}$, the required product (*Prin.*).

By cancellation (**38**), the operation is shortened, and the result is obtained in its lowest terms.

Multiplying the numerator, as in the first operation, increases the number of parts, their size remaining the same; dividing the denominator multiplies the fraction by increasing the size of the parts, their number remaining the same.

Ex. Multiply $123\frac{3}{4}$ by 9.

OPERATION.

$$\begin{array}{r} 123\frac{3}{4} \\ 9 \\ \hline 6\frac{3}{4} \\ 1107 \\ \hline 1113\frac{3}{4} \end{array}$$

ANALYSIS.—Multiply the fraction $\frac{3}{4}$ and the integer 123 separately, and add the products. In practice, when possible, add the products mentally; *e. g.*, 9 times $\frac{3}{4}$ are $\frac{27}{4}$, equal to $6\frac{3}{4}$. Write the $\frac{3}{4}$. 9 times 3 are 27, and 6 are 33. Write the 3, and proceed as in simple numbers.

Ex. Multiply 227¾ by 175.

OPERATIONS.

```
     227¾    Or,    227¾
     175            175
  4 )525             87½
     131¼            43¾
    1135           1135
   1589           1589
   227            227
   39856¼         39856¼
```

Analysis.—As in preceding example.

Or, by aliquot parts, when the fractions are fourths, eighths, etc., the fractions generally used in commercial operations.

¾ = ½ + ¼ (½ of ½).

½ of 175 = 87½.

¼ of 175, or ½ of 87½ = 43¾.

90. Rule.—*Multiply the numerator or divide the denominator of the fraction by the integer.*

When the multiplicand is a mixed number, multiply the fraction and integer separately, and add the results.

EXAMPLES.

91. *1.* Find the cost of 20 yards of silk at $⅞ a yard.

2. How much grain in 12 bins, each containing 76⅞ bushels?

3. If 1 man earns $⅞ in 1 day, how much will 16 men earn in 26 days?

4. If a ton of hay cost $16¾, how much will 22 tons cost?

5. Required the cost of 60 yards of muslin at 35⅜ cents a yard?

Multiply

6. $\frac{9}{16}$ by 7.
7. $\frac{11}{16}$ by 8.
8. $\frac{20}{27}$ by 3.
9. 110⅓ by 12.
10. 117¾ by 16.
11. 248⅝ by 3.
12. 146⅜ by 3.
13. 197⅛ by 7.
14. 420$\frac{9}{16}$ by 8.
15. 384⅝ by 12.
16. 375½ by 48.
17. 412⅜ by 47.
18. 148⅞ by 40.
19. 412$\frac{3}{7}$ by 89.
20. 775⅛ by 65.
21. 119$\frac{9}{16}$ by 20.
22. 772¾ by 17.
23. 338⅝ by 30.
24. 550⅝ by 27.
25. 643¾ by 121.
26. 875⅜ by 234.
27. 916½ by 275.
28. 234½ by 318.
29. 678⅔ by 427.
30. 625¾ by 516.
31. 718¼ by 542.
32. 275⅜ by 287.
33. 813⅝ by 319.
34. 444⅞ by 412.
35. 555⅚ by 875.
36. 817¾ by 416.
37. 913¼ by 375.
38. 787¾ by 525.

92. To multiply an integer by a fraction, or to find a fractional part of an integer.

93. PRINCIPLE.—*Multiplying by a fraction is taking such part of the multiplicand as the fraction is of a unit.*

Ex. If 1 ton of hay cost $18, what will $\frac{3}{4}$ of a ton cost?

OPERATIONS.

$$\begin{array}{r} 4\,\underline{)\,18} \\ 4\frac{1}{2} \\ \underline{3} \\ 13\frac{1}{2} \end{array} \qquad \begin{array}{r} \text{Or,} \\ 18 \\ \underline{3} \\ 4\,\underline{)\,54} \\ 13\frac{1}{2} \end{array} \qquad \begin{array}{c} \text{Or,} \\ \frac{3}{\underset{2}{\cancel{4}}} \text{ of } \frac{\overset{9}{\cancel{18}}}{1} = \frac{27}{2} = 13\frac{1}{2} \end{array}$$

ANALYSIS.—If 1 ton cost $18, $\frac{3}{4}$ of a ton will cost $\frac{3}{4}$ of $18. $\frac{3}{4}$ of $18 is 3 times $\frac{1}{4}$ of $18. $\frac{1}{4}$ of $18 is 4\frac{1}{2}$ (taking $\frac{1}{4}$ is the same as dividing by 4), and 3 times 4\frac{1}{2}$ is 13\frac{1}{2}$.

Or, $\frac{3}{4}$ of $18 is $\frac{1}{4}$ of 3 times $18. 3 times $18 is $54. $\frac{1}{4}$ of $54 is 13\frac{1}{2}$.

Ex. Find the product of 175 and 8$\frac{3}{4}$.

OPERATIONS.

$$\begin{array}{r} 175 \\ \underline{8\frac{3}{4}} \\ 4\,\underline{)\,525} \\ 131\frac{1}{4} \\ \underline{1400\phantom{\frac{1}{4}}} \\ 1531\frac{1}{4} \end{array} \qquad \text{Or,} \qquad \begin{array}{r} 175 \\ \underline{8\frac{3}{4}} \\ 43\frac{3}{4} \\ \underline{3\phantom{\frac{1}{4}}} \\ 131\frac{1}{4} \\ \underline{1400\phantom{\frac{1}{4}}} \\ 1531\frac{1}{4} \end{array}$$

ANALYSIS.—Multiply by the fraction $\frac{3}{4}$ and by the integer 8 separately, and add the products.

Ex. Multiply 275 by 47$\frac{3}{8}$.

$$\begin{array}{r} \text{FIRST OPERATION.} \\ 275 \\ \underline{47\frac{3}{8}} \\ 8\,\underline{)\,825} \\ 103\frac{1}{8} \\ 1925\phantom{\frac{1}{8}} \\ \underline{1100\phantom{\frac{1}{8}}} \\ 13028\frac{1}{8} \end{array} \qquad \begin{array}{r} \text{SECOND OPERATION.} \\ 275 \\ \underline{47\frac{3}{8}} \\ 34\frac{3}{8} \\ \underline{3\phantom{\frac{1}{8}}} \\ 103\frac{1}{8} \\ 1925\phantom{\frac{1}{8}} \\ \underline{1100\phantom{\frac{1}{8}}} \\ 13028\frac{1}{8} \end{array} \qquad \begin{array}{r} \text{THIRD OPERATION.} \\ 275 \\ \underline{47\frac{3}{8}} \\ 68\frac{3}{4} \\ 34\frac{3}{8} \\ 1925\phantom{\frac{1}{8}} \\ \underline{1100\phantom{\frac{1}{8}}} \\ 13028\frac{1}{8} \end{array}$$

ANALYSIS.—For the first and second operations, as in the preceding examples.

When the fractions are fourths, eighths, etc., multiply by means of aliquot parts.

$\frac{3}{8} = \frac{1}{4} + \frac{1}{8}$ ($\frac{1}{2}$ of $\frac{1}{4}$).

$\frac{1}{4}$ of 275 = 68$\frac{3}{4}$.

$\frac{1}{8}$ of 275, or $\frac{1}{2}$ of 68$\frac{3}{4}$ = 34$\frac{3}{8}$.

Multiply the remaining numerators together for the numerator, and the remaining denominators for the denominator.

EXAMPLES.

98. Find the product of

1. $\frac{3}{5}$ and $\frac{2}{5}$.
2. $\frac{2}{3}$ and $\frac{2}{7}$.
3. $\frac{3}{4}$ and $\frac{5}{12}$.
4. $\frac{2}{3}$ and $\frac{10}{7}$.
5. $\frac{5}{8}$ and $\frac{12}{5}$.
6. 6, $3\frac{1}{3}$, and $\frac{4}{5}$.
7. $5\frac{2}{3}$, $\frac{6}{7}$, and $\frac{21}{34}$.
8. $12\frac{1}{2}$, $10\frac{2}{3}$, and $\frac{5}{12}$.
9. $\frac{1}{8}$, $13\frac{1}{3}$, and $\frac{1}{5}$.
10. $26\frac{1}{4}$, $\frac{5}{7}$, and $\frac{2}{3}$.
11. $\frac{3}{4}$, $\frac{8}{9}$, and $16\frac{4}{7}$.
12. $13\frac{1}{3}$, $\frac{4}{5}$, and $\frac{7}{8}$.

Reduce the following compound fractions (**55**) to simple ones.

The word "of" is equivalent to the sign ×.

13. $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$.
14. $\frac{2}{3}$ of $3\frac{1}{7}$ of $\frac{4}{5}$.
15. $\frac{3}{8}$ of $\frac{5}{9}$ of $7\frac{1}{2}$.
16. $\frac{3}{4}$ of $\frac{7}{8}$ of $5\frac{1}{3}$.
17. $\frac{5}{6}$ of $\frac{8}{9}$ of 18.
18. $\frac{3}{8}$ of $11\frac{2}{3}$ of $\frac{5}{7}$.
19. $\frac{16}{21}$ of $\frac{14}{15}$.
20. $\frac{7}{12}$ of $\frac{8}{9}$ of $\frac{5}{72}$.
21. $\frac{5}{8}$ of $\frac{40}{49}$ of $\frac{14}{15}$.
22. $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{8}{9}$.
23. $\frac{1}{4}$ of $12\frac{1}{3}$ of $6\frac{2}{3}$.
24. $\frac{5}{6}$ of $\frac{18}{25}$ of $4\frac{3}{4}$.

Find the value of the following expressions:

25. $\frac{2}{3}$ of 1728.
26. $\frac{3}{4} \times 375$.
27. $\frac{7}{8}$ times 864.
28. $\frac{2}{3}$ of $75 \times \frac{3}{4}$ of $16\frac{2}{3}$.
29. $\frac{7}{8} \times \frac{3}{4}$ of $\frac{5}{12} \times \frac{8}{9}$.
30. $(\frac{4}{5} + \frac{9}{10}) \times (\frac{3}{7} + \frac{5}{14})$.
31. $(\frac{3}{4} - \frac{2}{3}) \times (\frac{7}{8} + \frac{3}{4})$.
32. $(\frac{5}{12} + \frac{3}{4}) \times (\frac{5}{14} - \frac{1}{7})$.
33. $37\frac{1}{2}$ times $\frac{2}{3}$ of $\frac{9}{10}$.
34. $\frac{3}{8}$ of $\frac{5}{9}$ by $\frac{5}{6}$ of $\frac{2}{3}$.

DIVISION.

99. To divide a fraction by an integer.

100. PRINCIPLE.—*Dividing the numerator or multiplying the denominator by a number divides the value of the fraction by that number* (**57**, *2*).

Ex. What cost 1 pound of tea, if 5 pounds cost \$$3\frac{1}{3}$?

OPERATIONS.

$$\frac{10}{3} \div 5 = \frac{10 \div 5}{3} = \frac{2}{3}$$

$$\text{Or, } \frac{10}{3} \div 5 = \frac{10}{3 \times 5} = \frac{10}{15} = \frac{2}{3}$$

$$\text{Or, } \frac{\overset{2}{\cancel{10}}}{3} \times \frac{1}{\cancel{5}} = \frac{2}{3}$$

ANALYSIS.—If 5 pounds cost \$$3\frac{1}{3}$, 1 pound will cost $\frac{1}{5}$ of \$$3\frac{1}{3}$, or \$$\frac{2}{3}$.

To divide $\frac{10}{3}$ ($3\frac{1}{3}$) by 5, divide the numerator 10 by 5, or multiply the denominator 3 by 5; either operation will give $\frac{2}{3}$, the required quotient (*Prin.*).

Dividing the numerator, as in the first operation, decreases the number of parts, their size remaining the same; multiplying the denominator divides the fraction by decreasing the size of the parts, their number remaining the same.

Ex. Divide $867\frac{3}{4}$ by 4.

OPERATION.

$$4\,)\,\underline{867\frac{3}{4}} \qquad 3\frac{3}{4} = \frac{15}{4}$$

$$216\frac{15}{16} \qquad \frac{15}{4} \div 4 = \frac{15}{16}$$

ANALYSIS.—Dividing as in simple numbers, 4 is contained in $867\frac{3}{4}$, 216 times and a remainder of $3\frac{3}{4}$. $3\frac{3}{4}$ equals $\frac{15}{4}$, which divided by 4 is $\frac{15}{16}$.

101. RULE.—*Divide the numerator or multiply the denominator of the fraction by the integer.*

When the dividend is a mixed number, divide the integer and the fraction separately, and add the results.

EXAMPLES.

102. Divide

1. $\frac{3}{4}$ by 6.
2. $\frac{5}{6}$ by 3.
3. $\frac{8}{9}$ by 6.
4. $\frac{5}{12}$ by 4.
5. $\frac{8}{17}$ by 4.
6. $16\frac{3}{4}$ by 5.
7. $172\frac{1}{2}$ by 3.
8. $875\frac{3}{8}$ by 6.
9. $935\frac{3}{4}$ by 8.
10. $729\frac{1}{3}$ by 9.
11. $637\frac{1}{2}$ by 9.
12. $875\frac{5}{11}$ by 12.
13. $1716\frac{2}{3}$ by 8.
14. $1729\frac{1}{3}$ by 3.
15. $2418\frac{3}{4}$ by 5.
16. $3516\frac{4}{7}$ by 5.
17. $2428\frac{3}{4}$ by 3.
18. $6375\frac{3}{8}$ by 4.
19. $4287\frac{7}{8}$ by 2.
20. $3281\frac{1}{7}$ by 8.
21. $5316\frac{2}{3}$ by 4.
22. $7144\frac{1}{3}$ by 5.
23. $1729\frac{3}{4}$ by 3.
24. $1749\frac{1}{4}$ by 9.
25. $8763\frac{1}{3}$ by 6.
26. $7385\frac{3}{4}$ by 8.
27. $4255\frac{7}{8}$ by 9.
28. $7134\frac{3}{4}$ by 7.
29. $9727\frac{1}{3}$ by 12.
30. $6345\frac{3}{5}$ by 16.

103. To divide by a fraction.

104. The **Reciprocal** of a number is 1 divided by that number. Thus, the reciprocal of 4 is 1 divided by 4, or $\frac{1}{4}$.

The **Reciprocal of a Fraction** is 1 divided by that fraction.

105. PRINCIPLE. 1 *divided by a fraction is the fraction inverted.*

Thus, 1 divided by $\frac{3}{4}$ is $\frac{4}{3}$. This principle may be demonstrated as follows: In 1 there are 4 fourths. 1 fourth is contained in 4 fourths 4 times. Since $\frac{3}{4}$ is 3 times $\frac{1}{4}$, $\frac{3}{4}$ is contained in 1 $\frac{1}{3}$ as many times as $\frac{1}{4}$. Hence, $\frac{3}{4}$ is contained in 1 $\frac{1}{3}$ of 4 times, or $\frac{4}{3}$ times.

The reciprocal of a fraction is the fraction inverted.

Ex. At $\$\frac{3}{4}$ a yard, how many yards of cloth can be bought for $5?

OPERATIONS.

$$5 \div \frac{3}{4} = \frac{20}{4} \div \frac{3}{4} = 6\frac{2}{3}$$

$$\text{Or, } 5 \div \frac{3}{4} = \frac{5}{1} \times \frac{4}{3} = \frac{20}{3} = 6\frac{2}{3}$$

ANALYSIS.—Since 1 yard cost $\$\frac{3}{4}$, as many yards can be bought for $5 as $\$\frac{3}{4}$ is contained times in $5. 5 is equal to $\frac{20}{4}$, and 3 fourths is contained in 20 fourths $6\frac{2}{3}$ times.

Or, $\$\frac{3}{4}$ is contained in $1 $\frac{4}{3}$ times (*Prin.*), and in $5, 5 times $\frac{4}{3}$ or $\frac{20}{3}$, equal to $6\frac{2}{3}$ times.

Ex. At $\$\frac{3}{4}$ a yard, how many yards of cloth can be bought for $\$\frac{5}{6}$?

OPERATIONS.

$$\frac{5}{6} \div \frac{3}{4} = \frac{10}{12} \div \frac{9}{12} = 1\frac{1}{9}$$

$$\text{Or, } \frac{5}{6} \div \frac{3}{4} = \frac{5}{6} \times \frac{4}{3} = \frac{20}{18} = 1\frac{1}{9}$$

$$\text{Or, } \frac{5}{6} \div \frac{3}{4} = \frac{5}{\underset{3}{\cancel{6}}} \times \frac{\overset{2}{\cancel{4}}}{3} = \frac{10}{9} = 1\frac{1}{9}$$

ANALYSIS.—Since 1 yard cost $\$\frac{3}{4}$, as many yards can be bought for $\$\frac{5}{6}$ as $\$\frac{3}{4}$ is contained times in $\$\frac{5}{6}$. $\frac{3}{4}$ is equal to $\frac{9}{12}$, and $\frac{5}{6}$ is equal to $\frac{10}{12}$. $\frac{9}{12}$ is contained in $\frac{10}{12}$ $1\frac{1}{9}$ times.

Or, $\$\frac{3}{4}$ is contained in $1 $\frac{4}{3}$ times (*Prin.*), and in $\$\frac{5}{6}$, $\frac{5}{6}$ times $\frac{4}{3}$ or $\frac{20}{18}$, equal to $1\frac{1}{9}$ times.

Ex. If $6\frac{2}{3}$ yards of cloth cost $5, what will 1 yard cost?

OPERATIONS.

$$5 \div \frac{20}{3} = (5 \div 20) \times 3 = \frac{3}{4}$$

$$\text{Or, } 5 \div \frac{20}{3} = \frac{5}{1} \times \frac{3}{20} = \frac{15}{20} = \frac{3}{4}$$

$$\text{Or, } 5 \div \frac{20}{3} = \frac{\cancel{5}}{1} \times \frac{3}{\underset{4}{\cancel{20}}} = \frac{3}{4}$$

ANALYSIS. $6\frac{2}{3}$ yards are equal to $\frac{20}{3}$ yards. Since $\frac{20}{3}$ yards cost $5, $\frac{1}{3}$ of a yard will cost $\frac{1}{20}$ of $5 or $\$\frac{1}{4}$, and $\frac{3}{3}$ or 1 yard will cost 3 times $\$\frac{1}{4}$ or $\$\frac{3}{4}$.

Or, the price per yard equals the cost, divided by the quantity as an abstract number. 5 divided by $\frac{20}{3}$ equals 5 times 1 divided by $\frac{20}{3}$, or 5 times $\frac{3}{20}$ (*Prin.*), equal to $\frac{3}{4}$.

ANALYSIS.—Reduce both divisor and dividend to improper fractions, and divide as in preceding examples.

[illegible] multiplying both divisor and dividend by the same number does not affect the quotient, multiply both divisor and dividend by their least common denominator, and divide as in simple numbers.

[illegible] the divisor and dividend to equi- [illegible] common denominator, and divide [illegible], the numerator of the [illegible]

[illegible] of the divisor and proceed as in multi- [illegible]

[illegible] number multiply both divisor and [illegible] common denominator and divide as [illegible]

EXAMPLES.

27. 920 by $73\frac{1}{5}$.
28. 720 by $43\frac{1}{5}$.
29. 700 by $37\frac{1}{2}$.
30. 560 by $26\frac{1}{4}$.
31. $682\frac{1}{2}$ by $45\frac{1}{3}$.
32. $847\frac{1}{8}$ by $89\frac{1}{4}$.
33. 984^3 by 75^3.
34. 862^2 by 18^3.
35. 731^1 by 56^1.
36. $431\frac{1}{4}$ by $18\frac{3}{4}$.
37. $983\frac{1}{3}$ by $29\frac{1}{2}$.
38. $504\frac{1}{6}$ by $36\frac{2}{3}$.
39. $583\frac{1}{3}$ by $43\frac{3}{4}$.

Find the value of the following complex fractions (**56**) and expressions of division :

40. $\frac{5\frac{1}{16}}{9}$; $\frac{4\frac{2}{3}}{35}$; $\frac{24\frac{3}{4}}{36}$.

41. $\frac{3\frac{1}{8}}{40}$; $\frac{8\frac{2}{3}}{13}$; $\frac{16\frac{2}{3}}{20}$.

42. $\frac{5\frac{1}{2}}{7\frac{1}{3}}$; $\frac{\frac{3}{4}}{\frac{7}{8}}$; $\frac{\frac{9}{10}}{\frac{3}{5}}$.

43. $\frac{\frac{2}{3}\text{ of }\frac{3}{4}}{\frac{1}{9}\text{ of }2\frac{1}{4}}$; $\frac{\frac{1}{4}+3\frac{1}{2}}{5\frac{2}{3}-3\frac{1}{6}}$.

44. $\frac{18\frac{1}{2}\div 12\frac{1}{3}}{16\frac{1}{2}-15\frac{5}{6}}$; $\frac{12\frac{1}{2}\times 11\frac{1}{5}}{68\frac{3}{4}+1\frac{1}{4}}$.

45. $\frac{175\frac{3}{4}-16\frac{7}{8}}{187\frac{1}{8}-186\frac{7}{8}}$; $\frac{38\frac{2}{3}-30\frac{1}{3}}{16\frac{1}{3}+8\frac{2}{3}}$.

108. To multiply mixed numbers together.*

Ex. What cost $1016\frac{1}{2}$ pounds of cotton, at $12\frac{3}{8}$ cents per pound ?

Instead of reducing the mixed numbers to improper fractions, use the following methods. The second method (by aliquot parts) is preferable, and is well adapted to commercial operations, in which the fractions are usually halves, fourths, eighths, etc.

In business transactions, it is customary to omit the fraction in the result, if it is less than $\frac{1}{2}$, and to add 1 to the cents if it is more than $\frac{1}{2}$. Unless otherwise stated, the exact answers will be given to examples.

FIRST OPERATION.

$$\begin{array}{r} 1016\frac{1}{2} \\ .12\frac{3}{8} \\ \hline 8\,)\,\underline{3049\frac{1}{2}} \\ 381\frac{3}{16} \\ 12198\phantom{\frac{3}{16}} \\ \hline 125.79\frac{3}{16} \end{array}$$

ANALYSIS.—Multiply $1016\frac{1}{2}$ by the fraction $\frac{3}{8}$ by multiplying by the numerator 3 and dividing by the denominator 8 (**92**); then multiply $1016\frac{1}{2}$ by the integer 12 (**88**), and add the results.

SECOND OPERATION.

$$\begin{array}{r} 1016\frac{1}{2} \\ .12\frac{3}{8} \\ \hline 254\frac{1}{8} \\ 127\frac{1}{16} \\ 12198\phantom{\frac{1}{16}} \\ \hline 125.79\frac{3}{16} \end{array}$$

ANALYSIS. $\frac{3}{8}=\frac{1}{4}+\frac{1}{8}$. Multiply $1016\frac{1}{2}$ by $\frac{1}{4}$ by dividing by 4. Multiply $1016\frac{1}{2}$ by $\frac{1}{8}$ by taking $\frac{1}{2}$ of the $254\frac{1}{8}$, the product by $\frac{1}{4}$. Multiply $1016\frac{1}{2}$ by 12 (**88**), and add the results.

---

* The multiplication of mixed numbers is purposely put in this connection, as it appropriately comes here, a knowledge of division of fractions being a prerequisite to a fair understanding of the process.

[illegible]

[illegible]

3164
1036
[illegible]

[illegible] mixed numbers,

[illegible] by 28[illegible].
[illegible] by 14[illegible].
[illegible]
[illegible]
[illegible] by 165[illegible].
[illegible] by 14[illegible].

[illegible] EXAMPLES.

110. 1 Reduce [illegible] to its lowest terms.
2 Reduce [illegible] to [illegible]
3 Reduce [illegible] to an improper fraction.
4 Reduce [illegible] to a mixed number.
5. Add [illegible], and 56[illegible].

6. From $1728\frac{1}{3}$ take $865\frac{3}{4}$.

7. Multiply $\frac{1}{3} \times 3\frac{1}{2} \times \frac{5}{14} \times \frac{3}{16} \times 16\frac{2}{3}$.

8. Multiply $1727\frac{3}{4}$ by 175.

9. Multiply 1727 by $175\frac{3}{4}$.

10. Divide $1\frac{7}{8}$ by $\frac{3}{16}$.

11. Divide 1736 by $144\frac{2}{3}$.

12. Divide $5779\frac{2}{3}$ by $275\frac{2}{3}$.

13. Divide $12346\frac{1}{4}$ by 7; by 35.

14. What is the cost of 1583 pounds sugar @ $11\frac{3}{4}$ cts. per pound?

15. Add $\frac{3}{5}$ of $\frac{7}{8}$ of $4\frac{1}{6}$, $\frac{5}{8}$, $136\frac{2}{3}$, and $\frac{5\frac{3}{8}}{\frac{7}{8}}$.

16. A merchant sold a quantity of goods for $7344, which was $\frac{3}{4}$ of the cost. What was the loss?

17. Required the value of 2993 pounds of sugar @ $9\frac{3}{8}$ cts. per pound?

18. If $\frac{7}{8}$ of a ship is worth $\$424301\frac{1}{3}$, what is the value of the whole?

19. Bought $47\frac{3}{4}$ yards of cloth at $\$4\frac{1}{2}$ per yard, and paid for it in wheat at $\$2\frac{1}{4}$ per bushel; how many bushels were required?

20. Find the value of $31\frac{13}{16}$ pounds snuff @ 72 cts. per pound.

21. The less of two numbers is $777\frac{3}{4}$ and their difference $117\frac{3}{8}$; what is the greater number?

22. A and B together have $1728; if A's money is equal to $\frac{3}{5}$ of B's, how much have each?

23. A merchant having $2146\frac{3}{4}$ yards of cloth, sold $\frac{5}{8}$ of it at $\$1\frac{3}{4}$ a yard, and the remainder at $\$2\frac{1}{2}$ a yard; how much did he receive?

24. A number being increased by $\frac{5}{8}$ of itself, the sum is 546; what is the number?

25. A man had $5280; he bought goods with $\frac{3}{8}$ of it, and then lent $\frac{1}{4}$ of the balance to a friend; how much had he left?

26. Find the selling price of goods sold at a profit of $75, being $\frac{3}{8}$ of the cost.

27. Mr. A bought $117\frac{3}{4}$ acres of land at one time, and $87\frac{5}{8}$ at another; after selling $110\frac{7}{8}$ acres, how much remained?

28. If $8\frac{3}{4}$ tons of coal cost $\$30\frac{5}{8}$, what will $27\frac{1}{2}$ tons cost? How many tons can be bought for $\$127\frac{3}{4}$?

29. A man paid $\$1145\frac{5}{8}$ for a horse and carriage. What was the value of each, the carriage being valued at $\frac{5}{8}$ as much as the horse?

30. If $\frac{3}{4}$ of a farm is valued at $\$2253\frac{1}{8}$, what is the value of $\frac{3}{8}$ of it?

31. What is the value of 2102^1 yards prints at 7^2 cents per yard?

32. What number must be taken from $96\frac{3}{4}$, and the remainder multiplied by $16\frac{2}{3}$, that the product shall be $770\frac{5}{6}$?

33. What is the value of 164^2 yards muslin at $5\frac{3}{4}$ cents per yard?

34. If 7 barrels of oil contain $313\frac{1}{4}$ gallons, how many gallons will $2\frac{3}{4}$ barrels contain?

35. An executor collects $12724.84. He pays out $4096.48 and the residue he disburses to the widow and her four children as follows: The widow receives a third part, and the remainder is divided equally among the children. What was the share of each?

36. What number increased by $\frac{3}{4}$ of itself will produce $2456\frac{1}{8}$?

37. Find the selling-price of goods, bought at $144, and sold at $\frac{1}{8}$ above cost.

38. A invests $\frac{5}{8}$ of his capital in real estate, and has $1725 remaining; what is his capital?

39. Bought a barrel of sugar containing 218 lbs., at $8\frac{1}{2}$ cents per pound. During the sale, it dried away $\frac{1}{10}$. Did I gain or lose, and how much, by selling it at $9\frac{1}{4}$ cents per pound?

40. Multiply $2375\frac{1}{2}$ by $8\frac{1}{2}$; by $10\frac{1}{4}$.

41. Multiply $1727\frac{3}{4}$ by $18\frac{1}{2}$; by $107\frac{3}{8}$.

42. Multiply $377\frac{1}{4}$ by $16\frac{1}{2}$; by $37\frac{3}{4}$.

43. Multiply $875\frac{1}{2}$ by $22\frac{1}{4}$; by $9\frac{5}{8}$.

44. A merchant sold $12\frac{7}{8}$ yards of silk to one customer, $21\frac{3}{4}$ to another, $20\frac{3}{8}$ to another, and $28\frac{1}{2}$ to another; at $\$2\frac{3}{8}$ per yard, how many dollars did he receive?

45. An army loses $\frac{3}{16}$ of its number in battle and has 16042 remaining; how many did it originally contain?

46. What is the cost of 34 pieces prints, containing 1604^2 yards, at 5^1 cents per yard?

47. What is the value of 12 pieces prints containing 48, 48^1, 48^2, 48, 49^2, 48^3, 48, 49^3, 49^2, 48^3, 49^2, 48^3 yards respectively at 4^3 cents per yard?

48. A merchant purchased 29 pieces prints containing 48^3, 48^2, 41^2, 48^2, 48^3, 47, 49, 49^2, 52^1, 57^3, 48^3, 48^2, 38, 48^2, 48^2, 48^2, 47^3, 48^2, 48, 51, 48, 44^1, 51^2, 48, 42^3, 46^2, 48, 48^2, 48^3 yards respectively; what was the cost at 5^2 cents per yard?

49. There are 5280 feet in one mile, and $16\frac{1}{2}$ feet in one rod; how many rods in one mile?

50. A can do a certain piece of work in 10 days, and B can do it in 15 days; how long will it take them both to do it?

51. A market-woman bought 120 oranges at the rate of 5 for 2 cents, and sold $\frac{1}{2}$ of them at the rate of 3 for 1 cent, and the remainder at the rate of 2 for 1 cent. Did she gain or lose, and how much?

52. What is the duty on 22375 pounds sugar, at $2\frac{13}{16}$ cts. per pound?

53. A farmer sold $1276\frac{19}{32}$ bushels oats at 44 cts. per bushel, $876\frac{22}{56}$ bushels corn at $52\frac{3}{4}$ cts., and $3381\frac{48}{60}$ bushels wheat at \$1.32; how much did he receive?

54. How many bushels of corn at $54\frac{1}{4}$ cts. per bushel must a farmer exchange for 62 yards of sheeting at $8\frac{3}{4}$ cts. per yard, and 31 yards broadcloth at \$1.75 per yard?

55. What is the value of 45^3 yards damask at 77^2 cts. per yard?

56. The salary of the President of the United States is \$50000 per year; how much is that per day?

57. $1\frac{4}{16}$ pounds of beef and $1\frac{6}{16}$ pounds of flour are allowed to ration; how much will 617 rations cost, if the price of beef is $11\frac{3}{8}$ cts. per pound, and of flour $3\frac{1}{4}$ cts. per pound?

58. What is the value of 36385 pounds of corn at $48\frac{3}{4}$ cents per bushel, each bushel containing 56 pounds?

59. Foreign immigration since 1870, by fiscal years:

Years.	Number.	Years.	Number.	Years.	Number.
1870......	356,303	1874......	260,814	1878......	138,469
1871......	346,938	1875......	191,231	1879......	177,826
1872......	437,750	1876......	237,991	1880......	457,257
1873......	422,545	1877......	141,857	1881......	669,439

According to the above table, what was the average immigration per year? What per month?

DECIMALS.

DEFINITIONS.

111. A **Decimal** (from the Latin *decem*, ten) **Fraction** is a fraction whose denominator is 1 followed by one or more ciphers; as $\frac{3}{10}$, $\frac{16}{100}$, $\frac{7}{1000}$.

112. Decimal fractions arise from dividing a unit into 10 equal parts, and then dividing these parts into 10 other equal parts, and so on.

Thus, if a unit be divided into 10 equal parts, each part is called a *tenth*. If a unit be divided into 100 equal parts, or 1 tenth into 10 equal parts, the parts are called *hundredths*. If a unit be divided into 1000 equal parts, or 1 hundredth into 10 equal parts, the parts are called *thousandths*.

113. All the rules, principles, operations, etc., of common fractions may be applied to decimal fractions. Since decimal fractions increase and decrease uniformly according to the scale of ten, a more simple notation, similar to that of integers, has been devised for them.

A hundred is written 100; a tenth part of a hundred (ten) is written 10, the 1 being written one place to the right; a tenth part of one ten (one unit) is written 1, the 1 being written one place to the right; in like manner, a tenth part of one unit (one-tenth) is written .1, the 1 being written one place to the right; the tenth part of one-tenth (one hundredth) is written .01, the 1 being written one place to the right, etc., etc.

Decimal fractions, like integers, decrease from left to right in a tenfold ratio, and increase from right to left in the same ratio.

114. In the decimal notation, the numerator only is written, the denominator being indicated by the position of a point (**.**) called the *decimal point*. The decimal point separates the integral from the fractional part.

115. The denominator of a decimal fraction is understood, and is 1 with as many ciphers annexed as there are figures in the decimal; thus,

Form of common fraction.		Form of decimal fraction.		
$\frac{7}{10}$	is written	.7	and is read	seven tenths.
$\frac{8}{100}$	" "	.08	" "	eight hundredths.
$\frac{16}{1000}$	" "	.016	" "	sixteen thousandths.

Hereafter, the first form, that of the common fraction, will be called a *fraction*, and the second, that of the decimal notation, a *decimal*.

116. The first place to the right of the point is called *tenths*, the second place *hundredths*, the third place *thousandths*, and so on.

117. The relation between integers and decimals is shown in the following

NUMERATION TABLE.

etc., etc.	*Billions.*	Hundred-Millions.	Ten-Millions.	*Millions.*	Hundred-Thousands.	Ten-thousands.	*Thousands.*	Hundreds.	Tens.	Units.	Decimal Point.	Tenths.	Hundredths.	*Thousandths.*	Ten-thousandths.	Hundred-Thousandths.	*Millionths.*	Ten-Millionths.	Hundred-Millionths.	*Billionths.*	etc., etc.
	2	4	3	6	8	0	7	5	9	3	.	6	8	9	4	6	0	5	8	2	
	10th.	9th.	8th.	7th.	6th.	5th.	4th.	3d.	2d.	1st.		1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	

Orders of Integers. Orders of Decimals.

118. In the above table, observe that the first place to the left of units is called *tens*, and the first place to the right, *tenths*; the second place to the left of units is called *hundreds*, and the second place to the right, *hundredths*, etc. Hence the number of any order or place of the decimal, counting from the point, or from units' place, is the same as the number of ciphers in the denominator of the decimal.

119. A Complex Decimal has a fraction in its right-hand place.

Thus, .16⅔ $\left(\frac{16\frac{2}{3}}{100}\right)$ is a complex decimal, and is read 16⅔ hundredths, the fraction not being counted as a decimal place.

120. PRINCIPLES.—1. *Annexing ciphers to a decimal does not alter its value.*

Annexing a cipher multiplies both the numerator and denominator by 10, and hence does not alter the value of the decimal (57, 3). Thus, .7 ($\frac{7}{10}$) = .70 ($\frac{70}{100}$) = .700 ($\frac{700}{1000}$).

2. *Each removal of the decimal point one place to the right multiplies the value of the decimal by 10.*

Removing the point one place to the right does not change the numerator, but divides the denominator by 10, and hence multiplies the value of the decimal (57, 1). Thus .072 ($\frac{72}{1000}$) becomes .72 ($\frac{72}{100}$); $\frac{72}{100} = \frac{72}{1000} \times 10$.

3. *Each removal of the decimal point one place to the left divides the value of the decimal by 10.*

Removing the point one place to the left does not change the numerator, but multiplies the denominator by 10, and hence divides the value of the fraction by 10 (57, 2). Thus, .72 ($\frac{72}{100}$) becomes .072 ($\frac{72}{1000}$); $\frac{72}{1000} = \frac{72}{100} \div 10$.

NUMERATION OF DECIMALS.

121. RULE.—*Read the decimal as if it were an integer, and give it the name of its right-hand order.*

EXERCISES.

122. Write in words, or read orally the following numbers:

1. .6.
2. .008.
3. .27.
4. .0375.
5. .0108.
6. .775.
7. .1007.
8. 17.6.
9. 8.029.
10. 24.000488.
11. 400.000088.
12. 76.7071.
13. 3000.0045.
14. .3045.
15. 375.18¾.
16. 19.0033⅓.
17. 6.148⅔.
18. 648.6⅔.
19. 347.18005.
20. 808.008.
21. 600.06.

NOTATION OF DECIMALS.

123. Write in the form of a decimal, sixty-four thousandths.

ANALYSIS. Since there are only two figures in the numerator 64, and the right-hand figure of the decimal must occupy the third decimal place to express thousandths, it is necessary to prefix a cipher to bring the right-hand figure into its proper place. Therefore write *point, naught, six, four* (.064) in the order named.

124. RULE.—*Prefix the decimal point, and decimal ciphers if necessary, to the numerator written as an integer, so that the right-hand figure will occupy the order named.*

NOTE.—Before writing, determine mentally the place of the right-hand figure and the number of ciphers required. Write in all cases from left to right.

EXERCISES.

125. *1.* What is the name of the third decimal order? The sixth? The first? The fourth?

2. How many decimal places are required to express hundredths? Millionths? Ten-thousandths? Tenths? Hundred-millionths?

3. How many ciphers must be written after the decimal point in writing 375 millionths? 27 hundredths? 875 thousandths? 446 ten-millionths? 37 ten-thousandths?

4. Write the following as decimals, so that the decimal-points stand in the same vertical line: 8 tenths; 16 hundredths; 175 thousandths; 1804 millionths; 56 ten-thousandths; 3004 ten-millionths; 1728 ten-thousandths.

NOTE.—In the following exercises, the comma is used to separate the integral and decimal parts.

5. Seventeen, and seventy-five hundredths.

6. Twenty-six, and twenty-six thousandths.

7. Two hundred and forty-six ten-millionths.

8. Two hundred, and forty-six ten-millionths.

9. Three hundred and seventy-five, and eighteen hundred-thousandths.

10. Eight thousand, and sixty-five ten-thousandths.

11. Eight thousand and sixty-five ten-thousandths.

12. $\frac{7}{10}$, $\frac{37}{100}$, $19\frac{3}{10}$, $218\frac{325}{1000}$, $\frac{1728}{10000}$.

13. $16\frac{75}{100}$, $19\frac{37}{1000}$, $345\frac{12}{1000}$, $\frac{75}{10000}$, $\frac{1234}{10000}$.

14. $28\frac{16}{1000}$, $37\frac{27}{100}$, $376\frac{2008}{1000000}$, $44\frac{1725}{10000}$, $\frac{5387}{1000000}$.

15. $170\frac{1256}{1000000}$, $16000\frac{225}{1000000}$, $38\frac{3}{100}$, $\frac{16225}{1000000}$.

16. $\frac{4}{10}$, $300\frac{75}{1000}$, $\frac{375}{1000}$, $1635\frac{216}{1000}$, $500\frac{63}{100}$.

17. $1027\frac{13}{100}$, $\frac{16}{100000}$, $\frac{214}{1000000}$, $387\frac{1012}{10000000}$.

REDUCTION.

126. To reduce a fraction to a decimal.

Ex. Reduce [illegible] to a decimal.

OPERATION.

[illegible] ANALYSIS. [illegible] units [illegible] units equal [illegible] hundredths. [illegible] hundredths equal .75 hundredths.

[illegible]

127. RULE.—*Annex decimal ciphers to the numerator, and divide by the denominator, pointing off as many decimal places in the quotient as there are ciphers annexed.*

128. A fraction in its lowest terms can be reduced to a pure decimal only when its denominator contains no prime factors but 2 and 5. If the denominator or divisor contain any prime factor other than 2 and 5, the division will not end. The decimals thus produced are called **Interminate** or **Repeating Decimals**, and the figures repeated, **Repetends**.

When a fraction is in its lowest terms, its numerator and denominator have no common factors (**61**). Annexing ciphers to the numerator introduces [illegible] 2 and 5 only. Hence, if the denominator is an exact divisor of the numerator with the ciphers annexed, it must contain these prime factors and no others.

EXAMPLES.

129. Reduce to equivalent decimals:

[illegible]	[illegible]	[illegible]	*10.* [illegible]	*13.* 16[illegible]
[illegible]	[illegible]	[illegible]	*11.* [illegible]	*14.* 27[illegible]
[illegible]	[illegible]	[illegible]	*12.* [illegible]	*15.* 36[illegible]

[illegible] decimal to a fraction.

[illegible] fraction.

[illegible] A decimal is changed to a [illegible] writing its denominator, and omit- [illegible] point and prefixed ciphers. [illegible] (63).

Ex. Change $.83\frac{1}{3}$ to a simple fraction.

OPERATION.

$$.83\tfrac{1}{3} = \frac{83\frac{1}{3}}{100} = \frac{83\frac{1}{3} \times 3}{100 \times 3} = \tfrac{250}{300} = \tfrac{5}{6}$$

ANALYSIS.—Reduce the complex fraction $\frac{83\frac{1}{3}}{100}$ to a simple fraction by multiplying both terms by the denominator 3. (**57**, 3.)

131. RULE.—*Omit the decimal point, supply the proper denominator, and reduce the fraction to its lowest terms.*

EXAMPLES.

132. Reduce to equivalent fractions:

1. .25.
2. .75.
3. .375.
4. .625.
5. .875.
6. .125.
7. .016.
8. .128.
9. .00144.
10. .512.
11. .5625.
12. .1875.
13. $.12\frac{1}{2}$.
14. $.16\frac{2}{3}$.
15. $.33\frac{1}{3}$.
16. $.41\frac{2}{3}$.
17. $.066\frac{2}{3}$.
18. $.37\frac{1}{2}$.
19. $.104\frac{1}{6}$.
20. $.097\frac{2}{9}$.
21. $.0053\frac{4}{7}$.
22. $.44\frac{4}{9}$.
23. $.142857\frac{1}{7}$.
24. $.0833\frac{1}{3}$.
25. 28.0375.
26. $107.166\frac{2}{3}$.
27. 175.096.
28. 6.0175.

ADDITION.

133. Since decimals, like integers, increase and decrease uniformly according to a scale of ten, with the exception of placing the decimal point in the result (usually called *pointing off*), they may be *added, subtracted, multiplied,* and *divided* in the same manner as integers.

Ex. What is the sum of 28.7, 175.28, .037, 25.0045, and 4.08?

OPERATION.

$$\begin{array}{r@{.}l} 28 & 7 \\ 175 & 28 \\ & 037 \\ 25 & 0045 \\ 4 & 08 \\ \hline 233 & 1015 \end{array}$$

ANALYSIS.—Write the numbers so that units of the same order stand in the same column.

If the decimal points are in the same vertical line, tenths will necessarily be under tenths, hundredths under hundredths, etc. Add as in integers, and place the point in the result directly under the points of the numbers.

[illegible]

[illegible] hundredths.

[illegible] ten-millionths

[illegible] hundred-thou-

[illegible] 625 ten-thou-

[illegible] thousandths?

[illegible] 443; 400.043;

[illegible] and 3016.

[illegible] thousandths; 157½ thou-

[illegible] hundredths; 1728 ten-

[illegible] $10.15½, $6.25; and

8. What is the sum of $\$12.37\frac{1}{2}$; $\$144.18\frac{3}{4}$; $\$6.62\frac{1}{2}$; $\$175.06\frac{1}{4}$; $\$40.17\frac{7}{8}$; and $398?

9. Add $.1264\frac{1}{3}$; 12.875; 187.25; $9.1414\frac{5}{6}$; .12; $5.7604\frac{7}{12}$; and $.0008\frac{2}{3}$.

10. Add $.26\frac{1}{2}$; $4.18\frac{3}{4}$; $.0017\frac{2}{3}$; $.00864\frac{1}{3}$; $.04\frac{2}{9}$; $17.387\frac{1}{3}$; and .0102075.

SUBTRACTION.

136. Ex. From 12.75 subtract 8.125.

OPERATION.
12.75
8.125
4.625

ANALYSIS.—Write the subtrahend under the minuend so that units of the same order stand in the same column. Subtract as in integers, and place the point in the result directly under the points of the numbers.

If, as in this example, the minuend has not as many decimal places as the subtrahend, suppose decimal ciphers to be annexed until the right-hand figures are of the same order. (**120.**)

Reduce complex decimals as in addition (**133**).

137. RULE.—*Write the numbers so that their decimal points are in the same vertical line. Subtract as in integers, and place the point in the remainder directly under the points in the minuend and subtrahend.*

EXAMPLES.

138. *1.* From four, and sixty-five thousandths, subtract eight hundred and forty-seven ten-thousandths.

2. From twenty-seven hundredths take twenty-nine hundred-thousandths.

3. From nine thousand, and thirty-four ten-thousandths, subtract nine thousand and thirty-four ten-thousandths.

Find the difference between

4. 8.3644 and 7.8996.
5. 17.4586 and .785.
6. 1.010101 and .999999.
7. $173.46 and $87.29.
8. 3 and .873845.
9. $17.24\frac{1}{2}$ and $18.973\frac{1}{4}$.
10. $510.60 and $\$389.45\frac{1}{2}$.
11. $1728 and $\$.06\frac{3}{4}$.
12. $17.864\frac{2}{3}$ and 16.94.
13. $144.43\frac{1}{3}$ and 113.3875.
14. $54.37\frac{5}{6}$ and $.98\frac{2}{3}$.
15. $117.48\frac{3}{4}$ and $49.43\frac{5}{6}$.
16. $448.987\frac{1}{3}$ and $389.28\frac{4}{9}$.
17. $5556.8\frac{1}{7}$ and 44.48.
18. $968.44\frac{4}{9}$ and $37.386\frac{2}{3}$.
19. $49.45\frac{1}{3}$ and $48.9876\frac{1}{6}$.

MULTIPLICATION.

139. Ex. Multiply .144 by .12.

OPERATION.
.144
.12
.01728

ANALYSIS.—For convenience, write the right-hand figures of the factors in the same vertical line.

$.144 \times .12 = \frac{144}{1000} \times \frac{12}{100} = \frac{1728}{100000}$. Multiply the numerators of the two factors for the numerator of the product, as in multiplication of fractions. In the above multiplication of fractions, it will be observed that the number of ciphers in the denominator of the product equals the sum of the ciphers in the denominators of the two factors. Since each cipher represents a decimal place, the product should have as many decimal places as both factors.

If the number of figures in the product is less than the number of decimal places in the two factors, supply the deficiency by prefixing ciphers.

140. RULE.—*Multiply as in integers, and from the right point off as many decimal places in the product as there are decimal places in the two factors.*

NOTE.—To multiply a decimal by 10, 100, 1000, etc., remove the decimal point as many places to the right as there are ciphers in the multiplier, annexing ciphers to the multiplicand, if necessary.

EXAMPLES.

141. 1. Multiply three hundred and forty-four ten-thousandths by twelve thousandths.

2. Multiply one hundred and ninety-two thousandths by four and nineteen hundredths.

3. What is sixteen hundredths of six hundred and thirty-two millionths?

4. What is five hundredths of $864.32? Of $845.75 [illegible]?

5. What is [illegible] of 364.65? Of 943.25?

6. What is [illegible] .25? 4.105 × .625 × .512?

[illegible] Multiply

[illegible] 12. 17.28 by .016⅔; by 2[illegible].

[illegible] 13. 64.32¼ by 1.44⅓; by .06[illegible].

[illegible] 14. 86.75 by 1.33⅓; by 5.7[illegible].

[illegible] 15. 3.78 by .0885; by .06[illegible].

[illegible] 16. 237.5 by .345¼; by 4.4[illegible].

17. Of 1728, what is .75? $.33\frac{1}{3}$? .25? .125? .20? .625?

18. Multiply (2.108 + .0074) by (12.684 — .465).

19. Multiply .01837 by 1000; .00145 by 100000; .6874 by 100; 5.375 by 10; 17.056 by 10000. What is the sum of the products?

20. What is the square of .0364? Of 20.75? Of 45.25?

21. What is the cube of 8.045? Of .0875? Of 67.375?

DIVISION.

142. Ex. Divide .01728 by 1.44.

OPERATION.

```
1.44 ) .01728 ( .012
        144
        ---
         288
         288
         ---
           0
```

ANALYSIS.—Dividing as in integers, without reference to the decimal points and prefixed ciphers, the quotient is 12. Since the dividend is the product of the divisor and quotient, it must contain as many decimal places as both of them.

Hence the number of decimal places in the quotient must equal the number in the dividend less the number in the divisor.

If, as in this example, the number of figures in the quotient is less than the number of decimal places to be pointed off, supply the deficiency by prefixing ciphers.

143. RULE.—*Divide as in integers, and point off from the right of the quotient as many decimal places as the number in the dividend exceed those in the divisor.*

NOTES.—1. If the divisor contains more decimal places than the dividend, before dividing make them equal by annexing ciphers to the dividend. If necessary to continue the division, more ciphers may be added.

2. If, after dividing all the figures of the dividend, there is a remainder, the division may be continued by annexing ciphers (**120**). The ciphers thus annexed must be regarded as decimal places of the dividend.

3. To divide a decimal by 10, 100, 1000, etc., remove the decimal point as many places to the left as there are ciphers in the divisor, prefixing ciphers to the dividend, if necessary.

EXAMPLES.

144. *1.* Divide three thousand four hundred and fifty-six hundred-thousandths by seventy-two hundredths.

2. Divide six, and twenty-five hundredths by twenty-five thousandths.

Divide

[illegible] by 4.16 | 8. .0648 by .00425 : by .0288.
[illegible] by 319. | 9. .31752 by .648 ; by .00384.
[illegible] by 125 | 10. .1898 by .33⅓ : by .0048⅜.
[illegible] by [illegible] | 11. 85.2451 by 4.56¼ : by 8.27½.
[illegible] by [illegible] | 12. 45.367 by .016⅔ ; by 1.080¼.

[illegible] by .25 : by .33⅓ : by .125 ; by .66⅔.

[illegible] what number?

[illegible] of what number?

[illegible] multiplied by to produce 448.5 ?

[illegible] divided by to produce 250 ?

[illegible] by 1000 ; 17380.5 by 10000 ;

[illegible] Find the sum of the quotients.

[illegible] how many [illegible] of $375.60 ?

[illegible] how many thousandths of $1728 ?

REVIEW EXAMPLES

[illegible] millionths, 48 ten-thou-

[illegible]

[illegible]

[illegible] to a decimal.

[illegible] to a fraction.

[illegible]

[illegible]

[illegible] to a fraction.

[illegible]

[illegible]

[illegible]

[illegible] what number?

[illegible]

[illegible] the cost of

20. What cost 12456 feet of plank at $8.75 per M.?

21. What is the value of 5 bbls. sugar, containing 312, 304, 301, 305, 304 pounds respectively, at $9\frac{3}{8}$ cents per pound?

22. A miller wishes to purchase an equal quantity of wheat, corn, and rye; he pays for wheat $\$2.22\frac{1}{2}$ a bushel; for corn, $98\frac{1}{2}$ cents a bushel; and for rye $\$1.16\frac{5}{8}$ a bushel. How many bushels of each can he buy for $92776.50?

23. Bought 280 cords of hard wood, at $6.75, and 790 cords of soft wood, at $\$3.62\frac{1}{2}$ per cord. Also, 750 bushels of corn, at $62\frac{1}{4}$ cents, and 925 bushels of oats, at $37\frac{1}{2}$ cents per bushel. What was paid for the whole, and what was the average price of wood per cord, and of grain per bushel?

24. Bought on contract 350 reams of foolscap paper, at $\$3.83\frac{1}{2}$ per ream, $45\frac{1}{2}$ reams of which were returned as unsuitable, and 275 reams of letter, at $\$2.67\frac{1}{2}$ per ream, $37\frac{1}{2}$ reams of which were rejected. How much was paid for the remainder?

25. A merchant paid for merchandise during the year $137618.75, and sold merchandise to the amount of $146347.87. What was the gain, if the net market value of the merchandise remaining unsold was $24378?

26. A quartermaster has $8345 on hand, and receives $4379.62 from each of six sales of property; he turns over to quartermaster A $2875.28, and pays $120 for corn. Upon being relieved from duty, he turns over to quartermaster B one-third of the residue, and divides the remainder equally among three others, C, D, and E. What was paid over to each?

27. Merchandise on hand, Jan. 1, 1879, $46312.85; merchandise sold during the year, $317829.32; merchandise purchased in the same time, $301449.72; merchandise on hand, Dec. 31, 1879, $61378.12. What was the net gain or loss?

28. A farmer sold land for $22.50 an acre, as follows: to A, $98\frac{3}{5}$ acres; to B, $\frac{3}{8}$ of the number sold to A; and to C, $\frac{1}{2}$ the number sold to A and B both. How much land was sold, how much did B and C each receive, and what was the amount realized?

29. What are the prime factors of 2791?

30. At $28.75 per thousand, how many feet of lumber should be given for 2816 pounds of sugar at $7\frac{3}{16}$ cts. per pound?

31. Mr. A offered to sell his horse for $\frac{3}{25}$ more than it cost him, but afterward sold it for $504, which was $\frac{1}{10}$ less than his first asking price. How much did his horse cost him?

[illegible]

[illegible] year [illegible] there were [illegible]

[illegible]

[illegible] kegs of butter [illegible] pounds of butter [illegible]

[illegible]

[illegible] each : how much [illegible] more than it cost, and [illegible]

[illegible] the money, and ⅔ of [illegible] had he at first?

[illegible] per yard. [illegible] price per yard [illegible] of the cost?

[illegible] bushels can [illegible]

[illegible] miles of railroad in operation in [illegible] miles. What was the aver- [illegible]

[illegible] Manual the above was taken, esti- [illegible] and quadruple tracks, sidings, [illegible] miles in 1858.

DENOMINATE NUMBERS.

DEFINITIONS.

146. A **Denominate Number** is a concrete number (7), and may be either *simple* or *compound.*

147. A **Simple Denominate Number** refers to units of the same name and value ; as 7 inches, 4 pounds.

148. A **Compound Denominate Number** refers to units of different names, but of the same nature ; as 3 feet 6 inches, 4 pounds 8 ounces.

149. Denominate numbers are used to express divisions of time, weights, measures, and moneys of different countries.

150. The scale of integers and decimals is uniform ; that of most denominate numbers is varying.

The moneys of the United States, Canada, France, Italy, Spain, Germany, Norway and Sweden, Denmark, Brazil, Japan, and of some other countries, and the metric system of weights and measures, have a uniform decimal scale.

DIVISIONS OF TIME.

151. The natural divisions of time are the *year* and the *day,* the other divisions being artificial. The year is the time in which the earth makes one revolution around the sun. The day is the time in which the earth makes one revolution on its axis.

152. The **Solar Day** is the interval between two consecutive returns of the sun to the meridian. On account of the varying motion of the earth around the sun, the solar days are of unequal length. For civil purposes in measuring time the average of all the days in the year is taken as the unit.

TIME.

60 Seconds (sec.) = 1 Minute . . . . min.
60 Minutes = 1 Hour . . . . hr.
24 Hours = 1 Day . . . . da.
7 Days = 1 Week . . . . wk.
365 Days
or 52 Weeks 1 Day, or = 1 Common Year . . . . yr.
12 Calendar Months
366 Days = 1 Leap Year . . . . yr.
100 Years = 1 Century . . . . C.

NOTE.—In many business transactions the year is regarded as 360 days, or 12 months of 30 days each.

153. The **Calendar Months** with the number of days they contain are as follows:

SEASON.		Days.	SEASON.		Days.
WINTER.	1. January (Jan.)	31.	SUMMER.	6. June	30.
	2. February (Feb.)	28.		7. July	31.
	in leap year	29.		8. August (Aug.)	31.
SPRING.	3. March (Mar.)	31.	AUTUMN.	9. September (Sep.)	30.
	4. April (Apr.)	30.		10. October (Oct.)	31.
	5. May	31.		11. November (Nov.)	30.
			WINTER.	12. December (Dec.)	31.

154. The **Solar Year** is the time between two consecutive returns of the sun to the vernal equinox. Its exact length is 365 *da.* 5 *hr.* 48 *min.* 50 *sec.* in mean solar time. For civil purposes the year consists of 365 or 366 days.

In the calendar established by Julius Cæsar, B.C. 46, and thence called the Julian calendar, three successive years were made to consist of 365 days each, and the fourth of 366 days. According to the Julian calendar, the average length of the year was 365¼ days, thus making an error of 11 min. 10 sec. each year, which in 400 years would amount to 78 hours, or about 3 days. In the [illegible] the excess of the Julian year above the true solar year [illegible] was 10 days. To correct the calendar [illegible] Pope Gregory XIII. decreed that 10 days should be [illegible] October, 1582, and that all centennial years [illegible] common years. Thus, the years 1700, 1800, and 1900, which [illegible] Julian calendar would be leap years, would [illegible] calendar be common years. This-calendar is sometimes called the Gregorian calendar. It is now used in all civilized countries except Russia.

The Julian and Gregorian calendars are also designated by the terms Old Style and New Style. In consequence of the years 1700 and 1800 being common years by the Gregorian calendar, the difference between the two styles is now 12 days. Thus, when it is July 4 in Russia, it is July 16 in other countries.

155. RULE FOR LEAP YEARS.—*All years divisible by 4, except centennial years, are leap years.*

All centennial years divisible by 400 are leap years.

LINEAR MEASURE.

156. Linear or **Long Measure** is used in measuring distances, also the length, breadth, and height of bodies, or their linear dimensions.

In measuring length, the yard derived from the standard yard of England is the standard unit, the yards of the United States and England being identical. Theoretically, the yard is equal to $\frac{360000}{391393}$ of the length of a pendulum that vibrates seconds in a vacuum, at the level of the sea in the latitude of London; that is, a pendulum that vibrates seconds under the above conditions is 39.1393 inches in length. The standard yard is, in fact, the distance between two points on a brass bar, preserved at Washington, the distance to be taken when the bar is at a temperature of 62° Fahrenheit. This bar was obtained from England in 1827.

TABLE.

12 Inches (*in.*)	= 1 Foot	*ft.*
3 Feet	= 1 Yard	*yd.*
5½ Yards	= 1 Rod	*rd.*
40 Rods	= 1 Furlong	*fur.*
8 Furlongs	= 1 Mile	*mi.*

mi.	*fur.*	*rd.*	*yd.*	*ft.*	*in.*
1 =	8 =	320 =	1760 =	5280 =	63360
	1 =	40 =	220 =	660 =	7920
		1 =	5½ =	16½ =	198
			1 =	3 =	36
				1 =	12

NOTES.—1. The inch is usually divided into halves, quarters, eighths, and sixteenths.

2. The foot and inch are divided by civil engineers and others into tenths, hundredths, thousandths, etc.

3. In measuring cloth, ribbon, and other goods sold by the yard, the yard is divided into halves, quarters, eighths, and sixteenths.

4. At the U. S. Custom Houses the yard is divided into tenths and hundredths.

5. The mile (5280 *ft.*) of the above table is the legal mile of the United States and England, and hence it is sometimes called the statute mile.

157. Other Denominations.—The following denominations are also used:

1 Point	= $\frac{1}{72}$ Inch.	Used by pendulum makers.
1 Line	= $\frac{1}{12}$ Inch.	
1 Size	= $\frac{1}{3}$ Inch.	Used by shoemakers.
1 Hand	= 4 Inches.	Used in measuring the height of horses.
1 Fathom	= 6 Feet.	Used in measuring depths at sea.
1 Cable-length	= 120 Fathoms, or 240 yards.	
1 Geographic Mile	= 1.15 + Statute Miles.	Used in measuring distances at sea.
1 Knot	= 1 Geo. Mile.	Used in determining the speed of vessels.
60 Geo. Miles, or 69.16 Stat. Miles	= 1 Degree	of latitude on a meridian, or of longitude on the equator.
360 Degrees	= the Circumference of the Earth.	

SURVEYORS' LINEAR MEASURE.

158. Surveyors' Linear Measure is used in measuring land, roads, etc.

The unit of this measure is a chain, 4 rods or 66 feet in length, called Gunter's Chain. It is divided into 100 parts called *links*, each link being 7.92 inches in length.

TABLE.

100 Links (*l.*) = 1 Chain . . . *ch.*
80 Chains = 1 Mile . . . . *mi.*

mi.	*ch.*	*ft.*	*l.*	*in.*
1 =	80 =	5280 =	8000 =	63360
	1 =	66 =	100 =	792
		.66 =	1 =	7.92

NOTES.—1. Links are written decimally as hundredths of a chain.

2. 1 rod = 25 links.

3. Engineers for railroad and other purposes use a chain or tape 100 feet long, the feet being divided into tenths.

SQUARE MEASURE.

159. Square Measure is used in measuring surfaces.

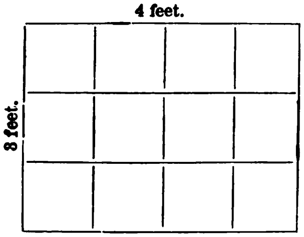
The unit of square measure is a square bounded by lines of some known length. Thus, a square inch is a square whose sides are one inch long; a square foot, a square whose sides are one foot long; etc.

TABLE.

144	Square Inches (*sq. in.*)	= 1 Square Foot . . .	*sq. ft.*
9	Square Feet	= 1 Square Yard . . .	*sq. yd.*
30¼	Square Yards	= 1 Square Rod . . .	*sq. rd.*
160	Square Rods	= 1 Acre	*A.*

NOTE.—1 Rood = 40 *sq. rds.* = ¼ *A.* The rood has practically gone out of use.

160. The **Area** of a surface is an expression for that surface in terms of square units.



In the diagram each small square represents a square foot. Since there are 3 rows, and 4 square feet in each row, there are 3 times 4 square feet, or 12 square feet in the rectangle. Hence, the *area* of any rectangle may be found by multiplying together the numbers denoting its length and breadth, in the same denomination; or, more briefly,

To find the area of a rectangle, multiply its length by its breadth.

SURVEYORS' SQUARE MEASURE.

161. Surveyors' Square Measure is used in measuring land.

TABLE.

10000	Square Links (*sq. l.*)	= 1 Square Chain . . .	*sq. ch.*
10	Square Chains	= 1 Acre	*A.*
640	Acres	= 1 Square Mile . . .	*sq. mi.*

NOTES.—1. 1 Pole or Perch = 1 *sq. rd.* = $\frac{1}{16}$ *sq. ch.* = $\frac{1}{160}$ *A.*

2. The acre is the common unit of land measure.

3. In the vicinity of St. Louis, and in other parts of the Mississippi valley that were settled by the French, the old French *arpent* is still used as the unit of land measure. It contains about ⅚ of an English acre.

162. U. S. Public Lands are divided by north and south lines run according to the true meridian, and by others crossing them at right angles, so as to form *townships* of six miles square.

Townships are subdivided into *sections*, containing, as nearly as may be, 640 acres each, or 1 square mile.

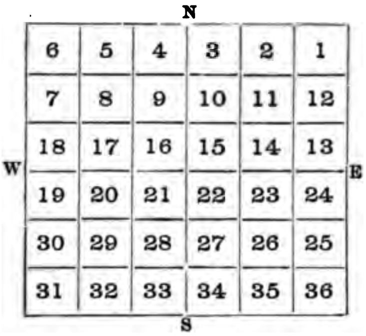
Sections are subdivided into *half-sections, quarter-sections, half-quarter-sections*, and *quarter-quarter-sections.*

TABLE.

1 Township	= 6 *mi.* × 6 *mi.*	= 36 *sq. mi.*	=	23040 *A.*
1 Section	= 1 " × 1 "	= 1 "	=	640 "
1 Half-Section	= 1 " × $\frac{1}{2}$ "	= $\frac{1}{2}$ "	=	320 "
1 Quarter-Section	= $\frac{1}{2}$ " × $\frac{1}{2}$ "	= $\frac{1}{4}$ "	=	160 "
1 Half-Quarter-Section	= $\frac{1}{4}$ " × $\frac{1}{2}$ "	= $\frac{1}{8}$ "	=	80 "
1 Quarter-Quarter-Section	= $\frac{1}{4}$ " × $\frac{1}{4}$ "	= $\frac{1}{16}$ "	=	40 "

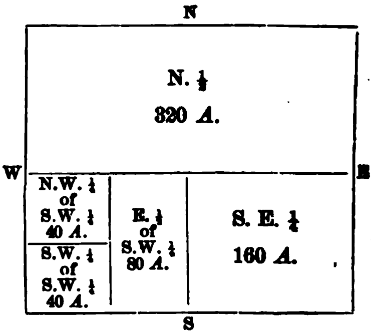
The following diagrams show the method of numbering the sections of a township, as also that of naming the subdivisions of sections.

A TOWNSHIP.



6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

A SECTION.



SOLID OR CUBIC MEASURE.

163. Solid or Cubic Measure is used in measuring solids, or bodies, which have length, breadth, and thickness or depth; as boxes, earth, wood, stone, etc.

The unit of cubic measure is a cube, each of whose edges is a unit of some known length. Thus, a cubic inch is a cube, each of whose edges is one inch; a cubic foot is a cube, each of whose edges is one foot; etc.

Table.

1728 Cubic Inches (*cu. in.*) = 1 Cubic Foot . . . . *cu. ft.*
27 Cubic Feet = 1 Cubic Yard . . . . *cu. yd.*

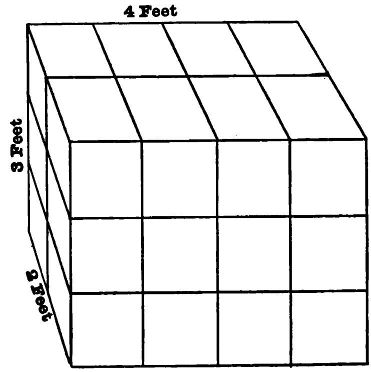
Notes.—1. 128 cubic feet = 1 cord of wood, or bark. Tanners, in measuring bark, use a measure in which the foot is divided into tenths.

2. The U. S. measurement ton for freight contains 40 cubic feet.

3. The U. S. register tonnage (entire internal cubical capacity) of vessels is expressed in tons of 100 cubic feet each.

164. The **Volume** or **Solid Contents** of a solid is an expression for that solid in terms of cubic or solid units.

The diagram represents a solid 4 feet long, 3 feet broad, and 2 feet thick. Each small cube is a cubic foot. Since the end of the solid contains (3 × 2) 6 square feet of surface, it is evident, if a section 1 foot thick be cut off from this end, it can be divided into 6 cubes, with edges 1 foot in length, and therefore the section will contain 6 cubic feet; and since the whole solid is 4 feet long, and contains 4 like sections, it must contain 4 times 6 cubic feet, or twenty-four cubic feet. Hence the volume of a rectangular solid may be found by multiplying together the numbers expressing its length, breadth, and thickness, in the same denomination; or, more briefly,



To find the volume of a rectangular solid, multiply together its length, breadth, and thickness.

165. **Lumber** is measured by *board measure.* The board foot is 1 *ft.* long, 1 *ft.* wide, and 1 *in.* thick; hence it is $\frac{1}{12}$ of a cubic foot.

Boards, plank, scantling, joists, and sawed timber generally are usually measured by *board* measure; hewn and round timber by *cubic* measure.

166. When lumber is not more than one inch thick, to find the number of feet board measure: *Multiply the length in feet by the width in inches, and divide the product by 12.*

When more than 1 inch thick: *Multiply the length in feet by the width and thickness in inches, and divide the product by 12.*

LIQUID MEASURE.

167. Liquid Measure is used for measuring liquids.

The unit of this measure is the wine gallon, which contains 231 cubic inches.

TABLE.

			gal.		*qt.*		*pt.*		*gi.*
4 Gills (*gi.*)	1 Pint . . .	*pt.*	1	=	4	=	8	=	32
2 Pints	1 Quart . . .	*qt.*			1	=	2	=	8
4 Quarts	1 Gallon . .	*gal.*					1	=	4

NOTES.—1. In estimating the capacity of tanks, cisterns, reservoirs, etc., 1 barrel = 31½ gallons, 1 hogshead = 2 barrels = 63 gallons.

2. In commerce, the barrel and hogshead are not fixed measures, but their capacity is found by gauging or actual measurement.

3. The imperial gallon of England contains 277.274 cubic inches, and is [illegible] wine gallons.

4. The beer gallon contains 282 cubic inches. It is no longer used in the U. S.

APOTHECARIES' FLUID MEASURE.

168. Apothecaries' Fluid Measure is used in prescribing [illegible] medicines.

[illegible] the wine gallon and pint.

[illegible]

[illegible] 128 = 1024 = 61440
[illegible] 16 = 128 = 7680
[illegible] = 480
[illegible] = 60

[illegible]

169. [illegible]

The unit of this measure is the Winchester bushel, which contains 2150.42 cubic inches.

TABLE.

2 Pints (*pt.*) = 1 Quart . . . *qt.*
8 Quarts = 1 Peck . . . *pk.*
4 Pecks = 1 Bushel . . . *bu.*

bu.	*pk.*	*qt.*	*pt.*
1 =	4 =	32 =	64
	1 =	8 =	16
		1 =	2

NOTES.—1. The half-peck or gallon of this measure contains 268.8 cubic inches.

2. The imperial bushel of England contains 2218.19 cubic inches, and is equal to 1.03 Winchester bushels.

3. Grain, seeds, etc., are usually sold by weight. For table of equivalents see Art. 173.

TROY WEIGHT.

170. Troy Weight is used in weighing gold, silver, coins, and jewels; also in philosophical experiments.

The unit of weight is the Troy pound, which contains 5760 grains. A cubic inch of distilled water weighs 252.458 of these grains, when the height of the barometer is 30 inches, and the temperature of the air and water 62° Fahrenheit.

TABLE.

24 Grains (*gr.*) = 1 Pennyweight *pwt.*
20 Pennyweights = 1 Ounce . . . *oz.*
12 Ounces = 1 Pound . . . *lb.*

lb.	*oz.*	*pwt.*	*gr.*
1 =	12 =	240 =	5760
	1 =	20 =	480
		1 =	24

NOTE.—The carat, used in weighing diamonds, equals 3.2 Troy grains.

The term carat is also used to denote the fineness of gold, and means $\frac{1}{24}$ part. Thus, gold 18 carats fine contains 18 parts pure gold and 6 parts alloy.

APOTHECARIES' WEIGHT.

171. Apothecaries' Weight is used in prescribing and compounding medicines not liquid.

The pound, ounce, and grain of this weight are the same as those of Troy weight, the division of the ounce being different.

TABLE.

			℔	℥	ʒ	℈	*gr.*
20 Grains (*gr.*)	= 1 Scruple	*sc.* or ℈.	1 =	12 =	96 =	288 =	5760
8 Scruples	= 1 Dram	*dr.* or ʒ.		1 =	8 =	24 =	480
8 Drams	= 1 Ounce	*oz.* or ℥.			1 =	3 =	60
12 Ounces	= 1 Pound	*lb.* or ℔.				1 =	20

NOTES.—1. The symbols precede the numbers to which they refer; thus, ℥ 6 ʒ 4, is 6 ounces 4 drams.

2. Drugs and medicines are sold in large quantities by Avoirdupois weight.

AVOIRDUPOIS WEIGHT.

172. Avoirdupois Weight is used in weighing all articles, excepting gold, silver, precious stones, and medicines in small quantities.

The Avoirdupois pound contains 7000 Troy grains.

TABLE.

			T.	*cwt.*	*lb.*	*oz.*
16 Ounces (*oz.*)	= 1 Pound	*lb.*	1 =	20 =	2000 =	32000
100 Pounds	= 1 Hundred-weight, or *cwt.* 1 Cental	*cwt.* *C.*		1 =	100 =	1600
20 Hundred-weight	= 1 Ton	*T.*			1 =	16

NOTES.—1. The ounce is divided into halves and quarters.

2. The dram, $\frac{1}{16}$ of an ounce, is now little used, except by silk manufacturers.

3. The Long or Gross ton, formerly used, contained 2240 pounds; the hundred-weight, 112 pounds; and the quarter, 28 pounds.

These weights are still used at the U. S. Custom Houses, in ocean freights, and in freighting and wholesaling coal from the mines.

173. In buying and selling grain, seeds, and other produce, the bushel is regarded as a certain number of pounds. The Boards of Trade of several of our leading cities, and the people generally, use the equivalents given in the following table:*

---

* These weights are the same as prescribed by the laws of most States, but the laws are not uniform. In inter-state commerce it is necessary to have common units, although they may differ from the units established by law. The laws are generally disregarded where the units prescribed by them differ from those prescribed by custom, or the laws of most of the States. As an instance of this irregularity, the State of New York prescribes 58 pounds as a bushel of corn, but the Boards of Trade and custom generally adopt 56 pounds as a bushel of corn. There can be no doubt but that an appeal to the courts of any one of the States would lead to a decision in accordance with the laws of that State in fixing the weight of a bushel of grain. It is further evident that decisions in State courts of last appeal might be as discordant upon this subject as the laws themselves.

TABLE OF AVOIRDUPOIS POUNDS IN A BUSHEL.

Commodities.	Lbs.	Commodities.	Lbs.	Commodities.	Lbs.
Barley.........	48	Corn, shelled...	56	Peas...........	60
Beans..........	60	Corn in the ear.	70	Rye............	56
Buckwheat.....	48	Malt...........	34	Timothy Seed..	45
Clover Seed ...	60	Oats..........	32	Wheat.........	60

In the Liverpool, San Francisco, and some other markets, produce is bought and sold by the *cental* of 100 pounds. Railway freight tariffs in the United States on grain, provisions, etc., are reckoned per *cwt.* or cental.

174. The following units are used in commerce:

1 Quintal of Fish	=	100 *lbs.*
1 Barrel of Flour	=	196 *lbs.**
1 Barrel of Pork	=	200 *lbs.*
1 Gallon Refined Petroleum	=	6½ *lbs.*
1 Gallon Crude Petroleum	=	6¼ *lbs.*
1 Keg of Nails	=	100 *lbs.*

CIRCULAR MEASURE.

175. Circular or Angular Measure is used in measuring angles and arcs of circles. It is employed principally by surveyors in determining directions, by navigators in determining latitude and longitude of places, and by astronomers in making observations.

The unit of this measure is the *degree*, which is $\frac{1}{360}$ of the circumference of any circle.

TABLE.

60 Seconds (″) = 1 Minute . . . . . ′.
60 Minutes = 1 Degree . . . . . °.
360 Degrees = 1 Circle . . . . . . C.

In order to prevent confusion, to remove the discrepancies which now exist, and to facilitate commerce, it is to be hoped that Congress will enact general laws on the subject, making the equivalents of a bushel uniform, or introducing the cental (or still better the metric) system.

* It is recommended by the leading Boards of Trade that all barrel flour contain 200 pounds, and all sack flour 50, 100, 150, or 200 pounds.

Flour is frequently exported from the United States to Great Britain in sacks of 140 pounds each. The sack of Great Britain usually contains 280 pounds.

2. In **writing** U. S. money, the decimal notation is used. *Dollars* are written at the left of the separatrix and form the integral part. *Cents* are written as *hundredths* of a dollar, and occupy the first two places at the right of the separatrix. *Mills* are written as *thousandths* of a dollar, and occupy the third decimal place.

Usually, in the final results of business operations, if the *mills* are more than *five*, they are regarded as an additional cent; if less than *five*, they are rejected.

3. In checks, notes, drafts, etc., *cents* are usually written as hundredths of a dollar in the form of a *fraction*. Thus, *six dollars and twenty-five cents* may be written, $\$6\frac{25}{100}$.

181. The legal coins of the United States are as follows:

GOLD.	Weight in grains.
1 dollar piece,	25.8
2½ dollar piece, or Quarter-eagle,	64.5
3 dollar piece,	77.4
5 dollar piece, or Half-eagle,	129.
10 dollar piece, or Eagle,	258.
20 dollar piece, or Double-eagle,	516.

SILVER.	Weight.
Standard dollar,	412½ grains.
Half dollar, or 50 cent piece,	12½ grams, or 192.9 grains.
Quarter Dollar, or 25 cent piece,	6¼ grams, or 96.45 grains.
Dime, or 10 cent piece,	2½ grams, or 38.58 grains.
COPPER AND NICKEL.	
5 cent piece,	5 grams, or 77.16 grains.
3 cent piece,	30 grains.
1 cent piece,	48 grains.

The Mill is not coined.

182. The **Trade Dollar** contains 420 grains of standard silver (.900 fine). It is not now coined, and is not a *legal tender*. It was originally coined for the purposes of trade in China and Japan.

183. The gold and silver coins of the United States contain 9 parts by weight of pure metal and 1 part alloy. The alloy of silver coins is copper; and the alloy of gold coins, copper, or copper and silver. (The silver in no case exceeds $\frac{1}{10}$ of the whole alloy.)

184. Gold Coins are a "*legal tender* in all payments at their nominal value when not below the standard weight and limit of tolerance"* provided by law; and, "when reduced in

---

* "Any gold coin of the United States, if reduced in weight by natural abrasion not more than one-half of one per centum below the standard weight prescribed by law, after a

weight, below said standard and tolerance, are a legal tender at valuation in proportion to their actual weight."

185. Standard Silver Dollars are "a *legal tender* at their nominal value for all debts and dues, public and private, except where otherwise expressly stipulated in the contract." "The Secretary of the Treasury is authorized and directed to purchase * * * silver bullion * * * not less than $2,000,000 worth per month, nor more than $4,000,000 worth per month, and cause the same to be coined monthly, as fast as so purchased, into such dollars." (Act of Feb. 28, 1878, Sec. 1.)

186. Silver Certificates.—Any holder of *standard silver dollars* "may deposit the same with the Treasurer, or any Assistant Treasurer of the United States, in sums not less than $10, and receive therefor certificates of not less than $10, each corresponding with the denominations of United States notes" (**189**). These certificates are "receivable for customs, taxes, and all public dues, and when so received may be reissued." (Act of Feb. 28, 1878, Sec. 4.)

187. Subsidiary Coins.—"The present (1880) silver coins of the United States of smaller denominations than $1" are "a legal tender in all sums not exceeding $10, in full payment of all dues, public and private." (Acts of 1st session, 46th Congress, Chap. XII, Sec. 3.)

"The holder of any of the silver coins of the United States of smaller denominations than $1 may, on presentation of the same in sums of $20, or any multiple thereof, at the office of the Treasurer or any Assistant Treasurer of the United States, receive therefor lawful money of the United States." (Acts of 1st session, 46th Congress, Chap. XII, Sec. 1.)

188. Minor Coins.—The 5 and 3 cent pieces contain ¾ copper and ¼ nickel. The 1 cent piece contains 95 per cent. copper and 5 per cent. tin and zinc. These coins are "a legal tender, at their nominal value, for any amount not exceeding twenty-five cents in any one payment."

189. United States Notes ("Greenbacks") are "a legal tender for all debts, public and private, except duties on imports

---

circulation of twenty years, as shown by its date of coinage, and at a ratable proportion for any period less than twenty years, is received at its nominal value by the United States treasury and its offices." The "Coinage Act of 1873" allows a deviation from the standard weight of ¼ of a grain, or less, in the manufacture of the dollar piece.

and interest on the public debt." Since Jan. 1, 1879, they have been redeemable "in coin * * * on their presentation for redemption at the office of the Assistant Treasurer of the United States in the City of New York, in sums of not less than $50." They represent the values of $1, $2, $5, $10, $20, $50, $100, $500, $1000, $5000, and $10,000. The Act of May 31, 1878, fixed their value at $346,681,016, and forbade their further contraction.

190. National Bank Notes are not a *legal tender;* but, since they are "secured by bonds of the United States deposited with the U. S. Treasurer at Washington," and are redeemed in lawful money by the national banks and the Treasurer of the United States, they are usually accepted in the payment of debts in any part of the United States. They are "receivable in all parts of the United States in payment of all taxes and excises and all other dues to the United States except duties on imports, and also for salaries and other debts and demands owing by the United States to individuals, corporations, and associations within the United States except interest on the public debt."

They represent the values of $1, $2, $5, $10, $20, $50, $100, $500, and $1000. Since Jan. 1, 1879, no notes of the denomination of $1 and $2 have been issued to national banks (R. S. 5175). Since the act of Jan. 14, 1875, the volume of national bank notes has been unlimited. Nov. 1, 1879, their total circulation, including gold banks, was $337,181,418.

ENGLISH MONEY.

191. English or Sterling Money is the legal currency of Great Britain.

TABLE.

				Value in U. S. money.
4 Farthings	=	1 Penny	*d.*	$ .02 +
12 Pence	=	1 Shilling	*s.*	.243 +
20 Shillings	=	1 Pound, or 1 Sovereign	£.	4.8665

NOTES.—1. 1 Crown = 5 shillings, or $\frac{1}{4}$ of a pound ($1.216 +).

2. 1 Guinea = 21 shillings ($5.11). It is not now coined.

3. The gold coins of Great Britain are 22 carats ($\frac{11}{12}$), or .916$\frac{2}{3}$ fine. (The old carat system (170, note) is generally abandoned except for jewelry. 1 carat = .041$\frac{2}{3}$.)

4. The silver coins of Great Britain are .925 ($\frac{37}{40}$) fine.

192. FOREIGN MONEYS OF ACCOUNT AND THEIR VALUES IN UNITED STATES MONEY.

Country.	Monetary Unit.	Standard.	Value in U. S. Money.
Austria	Florin of 100 kreuzers	Silver	[illegible]
Belgium	Franc of 100 centimes	Gold and silver	.19.3
Bolivia	Boliviano of 100 centavos	Silver	[illegible]
Brazil	Milreis of 1000 reis	Gold	.54.6
British N. America	Dollar of 100 cents	Gold	$1.00
Chili	Peso of 100 centavos	Gold and silver	.91.2
Cuba	Peso of 100 centavos	Gold and silver	.93.2
Denmark	Crown of 100 ore	Gold	.26.8
Ecuador	Peso of 100 centavos	Silver	[illegible]
Egypt	Piaster of 40 paras	Gold	.04.9
France	Franc of 100 centimes	Gold and silver	.19.3
Great Britain	Pound sterling	Gold	4.86 6½
Greece	Drachma of 100 lepta	Gold and silver	.19.3
German Empire	Mark of 100 pfennige	Gold	.23.8
India	Rupee of 16 annas	Silver	[illegible]
Italy	Lira of 100 centesimi	Gold and silver	.19.3
Japan	Yen of 100 sen	Silver	[illegible]
Liberia	Dollar of 100 cents	Gold	1.00
Mexico	Dollar of 100 centavos	Silver	[illegible]
Netherlands	Florin of 100 cents	Gold and silver	.40.2
Norway	Crown of 100 ore	Gold	.26.8
Peru	Sol of 100 centavos	Silver	[illegible]
Portugal	Milreis of 1000 reis	Gold	1.08
Russia	Rouble of 100 copecks	Silver	[illegible]
Sandwich Islands	Dollar of 100 cents	Gold	1.00
Spain	Peseta of 100 centimes	Gold and silver	.19.3
Sweden	Crown of 100 ore	Gold	.26.8
Switzerland	Franc of 100 centimes	Gold and silver	.19.3
Tripoli	[illegible]	Silver	74.3
Turkey	Piaster of 40 paras	Gold	.04.4
U. S. of Colombia	[illegible]	Silver	[illegible]
Venezuela	[illegible]	Gold and silver	.19.3

[illegible] Treasury, Jan. 1, [illegible] values of [illegible] Spain, [illegible] have [illegible] of [illegible] same value.

REDUCTION.

193. Reduction of Denominate Numbers is the changing their denomination without changing their value.

194. To reduce denominate numbers from higher to lower denominations.

Ex. How many pence in £8 16*s.* 7*d.*?

OPERATION.

£ *s.* *d.*
8 16 7
20
160*s.*
16*s.*
176*s.*
12
2112*d.*
7*d.*
2119*d.*

ANALYSIS.—Since there are twenty shillings in 1 pound, in 8 pounds there are 8 times 20 shillings, or 160 shillings. (For convenience multiply by 20 as an abstract number.) 160 shillings plus 16 shillings equal 176 shillings. Since there are 12 pence in 1 shilling, in 176 shillings there are 176 times 12 pence, or 2112 pence. 2112 pence plus 7 pence equal 2119 pence. When possible, add mentally the number of the lower denomination to the product.

195. RULE.—*Multiply the number of the highest denomination given by the number of the next lower denomination required to make 1 of this higher, and to the product add the given number, if any, of such lower denomination.*

Treat this result, and the successive results obtained, in like manner until the number is reduced to the required denomination.

EXAMPLES.

196. Reduce:

1. £9 13*s.* 10*d.* to pence.
2. 6 *gal.* 3 *qt.* 1 *pt.* to gills.
3. £112 18*s.* 5*d.* to farthings.
4. 6 *T.* 12 *cwt.* 65 *lb.* to pounds.
5. The year 1896 to hours.
6. The year 1881 to minutes.
7. £245 15*s.* 3 *far.* to farthings.
8. 48 *bu.* 3 *pk.* 6 *qt.* to quarts.
9. The year 1900 to hours.
10. 18 *lb.* 8 *oz.* to pennyweights.
11. 5 *mi.* 36 *rd.* 11 *ft.* to feet.
12. 456 miles to feet.
13. 16½ hands to inches.
14. 3 *mi.* 46 *ch.* 75 *l.* to links.
15. 7 *mi.* 55 *ch.* to rods.
16. 29 *sq. rd.* to square feet.
17. 97 *sq. rd.* to square yards.
18. 5 *sq. mi.* to acres.
19. 5 miles square to acres.
20. 16 cords 112 *cu. ft.* to *cu. ft.*

21. How many cubic feet in a vessel whose measurement is 2135 tons?

22. How many pounds in 16 *T.* 3 *qr.* 18 *lb.* (Long Ton Table)?

23. How many quarts in 3 *bbl.* 24 *gal.* cider?

24. How many pounds in 2375 bushels corn?

25. At 1 cent each, what is the value of 20 great gross pens?

26. How many days from Jan. 1, 1888, to Jan. 1, 1906?

27. How many days in 8 *m.* 26 *da.*?

197. To reduce denominate numbers from lower to higher denominations.

Ex. Reduce 2119 pence to higher denominations.

OPERATION.

12) 2119*d.*
20) 176*s.* + 7*d.*
£8 + 16*s.*
2119*d.* = £8 16*s.* 7*d.*

ANALYSIS.—Since there are 12 pence in 1 shilling, in 2119 pence there are as many shillings as 12 pence are contained times in 2119 pence, or 176 shillings, and 7 pence remaining. Since there are 20 shillings in 1 pound, in 176 shillings there are as many pounds as 20 shillings are contained times in 176 shillings, or 8 pounds, and 16 shillings remaining. Therefore, 2119*d.* = £8 16*s.* 7*d.*

198. RULE.—*Divide the given number by the number of that denomination required to make 1 of the next higher, reserving the remainder, if any, as part of the answer.*

Treat the quotient, and the successive quotients obtained, in like manner until the number is reduced to the required denomination. The last quotient and the several remainders will form the answer.

EXAMPLES.

199. Reduce

1. 8475*d.* to pounds.	*11.* 13387*d.* to pounds.
2. 9683 *cu. ft.* to cords.	*12.* 10224 *ft.* to fathoms.
3. 7534 *pts.* to bushels.	*13.* 60427 *l.* to chains.
4. 9817 *pts.* to barrels.	*14.* 16338 *ft.* to chains.
5. 5280 *ft.* to miles.	*15.* 5384 rods to chains.
6. 7633 *sq. yds.* to *sq. rds.*	*16.* 6375 *l.* to rods.
7. 8437 days to *com. yrs.*	*17.* 5316 *sq. rds.* to acres.
8. 6375 *hrs.* to weeks.	*18.* 49380 *sq. l.* to acres.
9. 9537 *sec.* to hours.	*19.* 38425 *sq. ch.* to *sq. mi.*
10. 6239 *in.* to rods.	*20.* 7685 poles to acres.

21. What is the cost of 465 yards of cloth at 9¼ pence per yard?

22. What is the value of 49375 pounds of corn at $0.64 per bushel?

23. What is the value of 27425 pounds of corn at $0.95 per cental?

24. Required the value of 18643 pounds of oats at 75 *cts.* per bushel.

25. Find the cost of 17387 pounds of oats at $1.88 per cental.

26. The report of a cannon is heard 4¾ seconds after the flash is seen; what is the distance of the cannon, if sound moves 1090 feet per second?

27. What cost 21370 pounds of straw at $8 per ton?

28. Required the cost of 875 pounds of feed at $1.15 per *cwt.*

29. In 327 days, how many months of 30 days each?

30. What is the freight of 39445 pounds of merchandise at 64*s.* per ton of 2240 pounds?

REDUCTION OF DENOMINATE FRACTIONS.

200. **A Denominate Fraction** is a fraction whose integral unit is a denominate number.

The principles, analyses, and rules of denominate fractions are essentially the same as those of denominate integers; therefore, no special rules are necessary for their reduction.

A sufficient number of illustrative examples are given to fully explain the different cases that may arise.

201. To reduce denominate fractions from higher to lower denominations.

Ex. Reduce $\frac{7}{16}$ of a £ to pence.

OPERATIONS.

$$\frac{7}{\underset{4}{\cancel{16}}} \times \frac{\overset{5}{\cancel{20}}}{1} = \frac{35}{4}s.$$

$$\frac{35}{\cancel{4}} \times \frac{\overset{3}{\cancel{12}}}{1} = 105d.$$

Or, $\frac{7}{\underset{\cancel{4}}{\cancel{16}}} \times \frac{\overset{5}{\cancel{20}}}{1} \times \frac{\overset{3}{\cancel{12}}}{1} = 105d.$

ANALYSIS.—Since there are 20 shillings in £1, in $\frac{7}{16}$ (.4375) of a £ there are $\frac{7}{16}$ (.4375) of 20 shillings, or $\frac{35}{4}$ (8.75) shillings. Since there are 12 pence in 1 shilling, in $\frac{35}{4}$ (8.75) shillings there are $\frac{35}{4}$ (8.75) times 12 pence, or 105 pence. Or, multiply the given fraction by the numbers of the scale required to reduce its denomination to the required denomination.

Ex. Reduce .4375 of a £ to pence.

OPERATION.

$.4375 \times 20 = 8.75s.$
$8.75 \times 12 = 105d.$

Or, £.4375

$$\begin{array}{r} £.4375 \\ 20 \\ \hline 8.7500s. \\ 12 \\ \hline 105.0000d. \end{array}$$

Analysis.—As in previous example.

Ex. Reduce $\frac{7}{16}$ of a £ to integers of lower denominations, *i.e.* to shillings and pence.

OPERATION.

$\frac{7}{16} \times \frac{20}{1} = \frac{35}{4} = 8\frac{3}{4}s.$
$\frac{3}{4} \times \frac{12}{1} = 9d.$
$£\frac{7}{16} = 8s.\ 9d.$

Analysis.—Multiplying by 20, $£\frac{7}{16} = 8\frac{3}{4}$ shillings. Reserve the integral part of the result, and reduce the fractional part to pence. Multiplying by 12, $\frac{3}{4}$ shilling = 9 pence. Hence, $£\frac{7}{16}$ = 8s. 9d.

Ex. Reduce .4375 of a £ to integers of lower denominations.

OPERATION.

$.4375 \times 20 = 8.75s.$
$.75 \times 12 = 9d.$

Or,

$$\begin{array}{r} £.4375 \\ 20 \\ s.\ 8|.7500 \\ 12 \\ d.\ 9|.0000 \end{array}$$

Analysis.—Multiplying by 20, £.4375 = 8.75 shillings. Reserve the integral part of the result, and reduce the decimal part to pence. Multiplying by 12, .75 shilling = 9 pence. Hence, £.4375 = 8s. 9d.

EXAMPLES.

203. 1. Reduce .625 of a £ to pence.

2. Reduce [illegible] of a £ to shillings and pence.

3. Reduce [illegible] of a £ to pence.

4. Reduce [illegible] of a £ to integers of lower denominations.

5. Change £[illegible] to lower denominations.

6. Change [illegible] to lower denominations.

7. If 1 pound sterling can be bought for $4.87, how many pounds can be bought for $1000?

8. Reduce [illegible] to lower denominations.

9. A cistern is 16.25 *ft.* long, 9.6 *ft.* wide, and 6.25 *ft.* deep; what is its capacity in *cu. yd.* etc.?

10. A certain sum at a certain rate will in 1 *yr.* produce $60 interest; in what time will the same sum at the same rate produce $15.50 interest?

203. To reduce denominate numbers to fractions (or decimals) of higher denominations.

Ex. Reduce $\frac{3}{5}$ of a penny to the fraction of a £.

OPERATIONS.

$\frac{3}{5} \div 12 = \frac{1}{20}$ *s.*

$\frac{1}{20} \div 20 = \frac{1}{400}$ £.

Or, $\frac{\cancel{3}}{5} \times \frac{1}{\underset{4}{\cancel{12}}} \times \frac{1}{20} = \frac{1}{400}$ £.

ANALYSIS.—Divide the given fraction by the numbers of the scale required to reduce pence to pounds.

If the answer is required in the form of a decimal, reduce the resulting fraction to a decimal by Art. 127. £$\frac{1}{400}$ = £.0025.

Ex. Reduce .6 of a penny to the decimal of a £.

OPERATION.

$$\begin{array}{r|l} 12 & .6 \ d. \\ \hline 20 & .05 \ s. \\ \hline & £.0025 \end{array}$$

ANALYSIS.—As in previous example.

If the answer is required in the form of a fraction, reduce the resulting decimal to a fraction by Art. 131. £.0025 = £$\frac{1}{400}$.

Ex. Change 9 pence to the fraction of a £.

OPERATIONS.

$\frac{\overset{3}{\cancel{9}}}{1} \times \frac{1}{\underset{4}{\cancel{12}}} \times \frac{1}{20} = \frac{3}{80}$ £.

Or, £$\frac{9}{240}$ = £$\frac{3}{80}$.

ANALYSIS.—For first operation, as in previous example.

Or, since there are 240 pence in £1, 1 penny equals $\frac{1}{240}$ of a £, and 9 pence equal $\frac{9}{240}$, or $\frac{3}{80}$ of a £.

Ex. Reduce 9 pence to the decimal of a £.

OPERATIONS.

$$\begin{array}{r|l} 12 & 9. \quad d. \\ \hline 20 & .75 \quad s. \\ \hline & .0375 \ £. \end{array}$$

ANALYSIS.—As in previous example.

Or, £$\frac{9}{240}$ = £$\frac{3}{80}$ = £.0375.

Ex. Reduce 12*s.* 9*d.* to the fraction of a £.

OPERATION.

12*s.* 9*d.* = 153*d.*

£1 = 240*d.*

$\frac{153}{240} = \frac{51}{80}$ £.

ANALYSIS.—12 shillings 9 pence = 153 pence. Since £1 = 240 pence, 1 penny equals $\frac{1}{240}$ of a £. and 153 pence equal $\frac{153}{240}$, or $\frac{51}{80}$ of a £.

Ex. Reduce £18 12*s.* 9*d.* to the decimal of a £.

OPERATION.

$$\begin{array}{r|l} 12 & 9.\ d. \\ \hline 20 & 12.75\ s. \\ \hline & £18.6375 \end{array}$$

ANALYSIS.—Write the denominations given in a vertical column, the lowest denomination at the top. Since there are 12 pence in 1 shilling, 9 pence are equal to .75 shilling; to which annexing the 12 shillings given, we have 12.75 shillings. Since there 20 shillings in £1, 12.75 shillings are equal to £.6375, to which annexing the £18, we have £18.6375. Hence £18 12*s.* 9*d.* = £18.6375.

EXAMPLES.

204. *1.* Reduce ⅝ of a penny to the fraction of a pound.

2. Reduce .875 of a shilling to pounds.

3. Change 12 *cwt.* to the decimal of a ton.

4. Reduce 420 grains to the fraction of an ounce Troy.

5. Reduce ¾ of a penny to the decimal of a pound.

6. What part of a mile is .165 of a foot?

7. What decimal of a £ are 18*s.* 6*d.* ?

NOTE.—The following method for reducing shillings, pence, and farthings to the decimal of a pound is sufficiently accurate for most business purposes: *Write one-half of the greatest even number of shillings as tenths, and if there be an odd shilling write 5 hundredths; reduce the pence and farthings to farthings, and write their number as thousandths. If the number of farthings is between 12 and 36, add 1 to the thousandths; if between 36 and 48, add 2 to the thousandths.* Thus, £8 17*s.* 8*d.* = £8 + £.85 + £.033 = £8.883.

8. Reduce 116 *cu. ft.* to the decimal of a cord.

9. Reduce £247 14*s.* 9*d.* to pounds.

10. What decimal of an acre are 16 *sq. rds.* ?

11. Reduce 75 feet to the fraction of a mile.

12. Reduce £27 10*s.* 6*d.* to pounds.

13. What is the cost of 22480 pounds of coal at $4.25 per ton (2240 pounds)?

14. What is the cost of 16 *tons* 12 *cwt.* of "Nut" coal at $6.80 per ton, and 8 *tons* 16 *cwt.* of "Chestnut" coal at $6.10 per ton?

15. What is the cost of 8364 pounds of oats at $1.65 per cental?

16. What is the cost of 8375 pounds of oats at $0.56 per bushel?

17. If 1 pound is equivalent to $4.87¾, what is the value of £1234 16*s.* 9*d.* in U. S. money?

18. Reduce £25 12*s.* 6*d.* to the decimal of a £, and multiply the result by .05.

ADDITION.

205. Denominate numbers are *added, subtracted, multiplied,* and *divided* by the same general methods as are employed for like operations in abstract numbers. The only difference arises from the use of a *varying* scale instead of the uniform scale of 10.

Ex. Add £5 11*s.* 4*d.*, £7 14*s.* 9*d.*, £6 16*s.* 8*d.*, and £7 5*s.* 9*d.*

OPERATION.

£	*s.*	*d.*
5	11	4
7	14	9
6	16	8
7	5	9
27	8	6

ANALYSIS.—Write the numbers so that like denominations stand in the same column, and begin to add at the right. The sum of the pence is 30*d.* = 2*s.* 6*d.* Write the 6*d.* under the column of pence, and add the 2*s.* to the column of shillings, obtaining for the sum 48*s.* = £2 8*s.* Write the 8*s.* under the column of shillings, and add the £2 to the column of pounds, obtaining for the sum £27; which write under the column of pounds, producing the entire sum, £27 8*s.* 6*d.*

EXAMPLES.

206. *1.* Add £16 5*s.* 4*d.*, £12 8*s.* 9*d.*, £13 14*s.* 8*d.*, £42 0*s.* 7*d.*, and 18*s.* 6*d.*

2. Add 3 *T.* 19 *cwt.* 2 *qr.* 16 *lb.*, 4 *T.* 13 *cwt.* 3 *qr.* 14 *lb.*, 18 *T.* 13 *cwt.* 24 *lb.*, and 42 *T.* 8 *cwt.* 1 *qr.* 22 *lb.* (Long Ton Table).

3. Add £163 16*s.* 11*d.*, £52 8*s.* 6*d.*, £3 14*s.* 2*d.*, £84 12*s.* 11*d.*, £106 1*s.* 4*d.*, and £49 13*s.* 8*d.*

4. Add 1 *yr.* 6 *mo.* 10 *da.*, 3 *yr.* 8 *mo.* 24 *da.*, 4 *yr.* 11 *mo.* 16 *da.*, 3 *mo.* 18 *da.*, and 1 *yr.* 8 *mo.* 8 *da.*

5. Add 8 *cd.* 106 *cu. ft.*, 3 *cd.* 85 *cu. ft.*, 2 *cd.* 113 *cu. ft.*, and 5 *cd.* 114 *cu. ft.*

6. Add 16 *hr.* 43 *min.* 48 *sec.*, 3 *hr.* 12 *min.* 40 *sec.*, 1 *hr.* 49 *min.* 13 *sec.*, and 5 *hr.* 19 *sec.*

7. Add 116° 32′ 44″, 8° 28′ 53″, 10° 44′ 12″, and 16° 18′ 13″.

8. Add 12 *ch.* 13 *l.*, 16 *ch.* 92 *l.*, 83 *ch.* 5 *l.*, 4.16 *ch.*, and 5.05 *ch.*

9. Add 1 *lb.* 11 *oz.* 18 *pwt.* 14 *gr.*, 2 *lb.* 8 *oz.* 10 *pwt.*, 4 *lb.* 5 *oz.* 18 *gr.*, and 10 *oz.* 13 *pwt.* 12 *gr.*

10. Add 16 *gal.* 3 *qt.* 1 *pt.*, 45 *gal.* 2 *qt.*, 17 *gal.* 1 *qt.* 1 *pt.*, 4 *gal.* 3 *qt.*, 15 *gal.* 1 *pt.*, and 24 *gal.* 3 *qt.* 1 *pt.*

11. Add £17 16*s.* 8*d.*, £37 13*s.* 5*d.*, £46 7*d.*, £11 5*s.* 10*d.*, £8 4*s.*, £38 19*s.* 3*d.*, and £45 12*s.* 8*d.*

12. Add £175 14*s.* 9*d.*, £37 9*s.* 3*d.*, £5 10*s.* 9*d.*, 17*s.* 3*d.*, £55 17*s.*, £3 6*s.* 9*d.*, £44 18*s.* 5*d.*, £218 15*s.* 6*d.*, and £3 11*s.* 11*d.*

SUBTRACTION.

207. Ex. From £10 6*s.* 4*d.* take £8 15*s.* 3*d.*

OPERATION.

£	*s.*	*d.*
10	6	4
8	15	3
1	11	1

ANALYSIS.—Write the numbers so that like denominations stand in the same column, and begin to subtract at the right. 3*d.* from 4*d.* leaves 1*d.*, which write under the column of pence. Since 15*s.* cannot be subtracted from 6*s.*, take £1 = 20*s.* from £10, leaving £9, and add it to the 6*s.*, making 26*s.* 15*s.* from 26*s.* leaves 11*s.*, which write under the column of shillings. £8 from £9 leaves £1, which write under the column of pounds. Hence the difference required is £1 11*s.* 1*d.*

EXAMPLES.

208. *1.* From £175 16*s.* 8*d.* take £87 12*s.* 6*d.*

2. From £84 10*s.* 2*d.* take £63 5*s.* 10*d.*

3. From £16 6*s.* 11*d.* take £12 12*s.* 8*d.*

4. From £48 10*s.* 8*d.* take £24 16*s.* 10*d.*

5. From 16 *yr.* 8 *mo.* 10 *da.* subtract 12 *yr.* 5 *mo.* 8 *da.*

6. From 1880 *yr.* 10 *mo.* 16 *da.* take 1876 *yr.* 5 *mo.* 24 *da.*

7. From 1881 *yr.* 4 *mo.* 25 *da.* take 1880 *yr.* 10 *mo.* 15 *da.*

8. From 1882 *yr.* 3 *mo.* 20 *da.* take 1879 *yr.* 8 *mo.* 26 *da.*

9. From 8 *hr.* 16 *min.* 44 *sec.* subtract 6 *hr.* 18 *min.* 40 *sec.*

10. From 105° 43′ 12″ subtract 87° 49′ 16″.

11. From 18 *T.* 16 *cwt.* 3 *qr.* 21 *lb.* take 1 *T.* 2 *cwt.* 2 *qr.* 25 *lb.* (Long Ton Table).

209. To find the interval of time between two dates.

210. There are two methods in common use for finding the time between two dates: 1, by compound subtraction, in which the result is given in years, months, and days, and in which 12 months are considered a year, and 30 days a month; 2, the result is given in days, or in years and days, and the true number of days is taken for each month.

Ex. Find the time in months and days from Apr. 24 to Nov. 10.

OPERATION.

mo.	*da.*
11	10
4	24
6	16

ANALYSIS.—Represent the months and days by their numbers and find their difference by compound subtraction, writing the later date as the minuend and the earlier as the subtrahend.

In many examples the interval may be found mentally as follows: From Apr. 24 to Oct. 24 are 6 *mo.*; in Oct. there are 6 more days after the 24th (regarding each month as 30 days), and in November to Nov. 10th inclusive, there are 10 days. Hence the total time between the given dates is 6 *mo.* 16 *da.*

The above methods may be used for finding the exact interval in days by making the necessary corrections. 6 *mo.* 16 *da.* = 196 *da.* From Apr. 24 to Nov. 10, there are 4 months containing 31 *da.* each; hence the true answer is 196 *da.* + 4 *da.*, or 200 *da.*

NOTE.—When the month of February is included, subtract 2 days in a common year, and 1 day in a leap year.

Ex. Find the time from May 18, 1876, to Mar. 2, 1882.

OPERATION.

yr.	*mo.*	*da.*
1882	3	2
1876	5	18
5	9	14

ANALYSIS.—As in preceding example.

Ex. What is the exact number of days from July 20, 1880, to Nov. 10, 1881?

OPERATION.

365	from July 20, 1880, to July 20, 1881.
11	remaining in July.
31	in August.
30	in September.
31	in October.
10	in November.
478	from July 20, 1880, to Nov. 10, 1881.

ANALYSIS.—In finding the interval between two dates the last day is counted, and not the first. Since the time is more than one year, write down 365 days as the number of days from the first date to the same date of the next year. Next write down the number of days in the month of July after the 20th, then the number of days in each of the full calendar months, and finally the number of days in November to Nov. 10 inclusive. The sum of these numbers will be the required time.

EXAMPLES.

211. Find the time by compound subtraction from

1. Jan. 10 to Aug. 28.
2. Mar. 16 to Dec. 4.
3. Feb. 5, 1880, to Oct. 16, 1881.
4. Jan. 27, 1881, to July 4, 1883.
5. May 16, 1882, to Mar. 24, 1884.
6. June 28, 1881, to Apr. 10, 1882.
7. July 30, 1882, to May 12, 1883.
8. Aug. 16, 1883, to Jan. 1, 1885.

Find also the exact number of days between the above dates.

MULTIPLICATION.

212. 1. Multiply £7 16s. 8d. by 11.

[illegible]

[illegible] 11 times 8d. are 88d. = 7s. 4d. Write the 4d. under the pence, and add the 7s. to the product of shillings. 11 times 16s. are 176s., plus 7s. from the preceding product are 183s. = £9 3s. Write the 3s. under the shillings, and add the £9 to the product of pounds. 11 times £7 are £77, plus £9 from the preceding product are £86, [illegible] Hence the entire product is £86 3s. 4d.

2. Multiply £8 12s. 6d. by .05.

£8.625
.05
£ .43125
20
s. 8.62500
12
d. 7.50000

[illegible] Reduce the multiplicand to the decimal of a pound by Art. 203, perform the required multiplication, and reduce the result to shillings and pence by Art. 201.

$$£8\ 12s.\ 6d. = £8.625$$

$$£8.625 \times .05 = £.43125$$

$$£.43125 = 8s.\ 7.5d.$$

EXAMPLES.

213. 1. Multiply £17 10s. 8d. by 9; by 11; by 15.

2. How many cords of wood in 12 loads, each load containing 2 cd. 108 cu. ft.?

3. What is the cost of 25 yd. of silk, at £1 3s. 6d. per yd.?

4. What is .05 of £127 10s. 6d.? Of £145 15s. 9d.?

5. What is the weight of 24 silver spoons, each spoon weighing 1 oz. 13 pwt.?

6. Multiply [illegible] by 10; by 12; by 18.

7. If [illegible] work 17 da. 16 hr. [illegible] to perform it?

8. Multiply 21 [illegible] by [illegible]; by .07.

9. What will [illegible] gallon?

10. [illegible] containing 3 bu. 3 pk.

11. [illegible] how far will [illegible]

DIVISION.

214. Ex. If 6 *yds.* of cloth are worth £8 18*s.* 6*d.* what is 1 *yd.* worth?

OPERATION.

$$\begin{array}{r|rrr} & £ & s. & d. \\ 6) & 8 & 18 & 6 \\ \hline & 1 & 9 & 9 \end{array}$$

ANALYSIS.—1 *yd.* is worth 1 *sixth* as much as 6 *yd.* $\frac{1}{6}$ of £8 is £1 and £2 remaining. Write the £1 in the quotient, and reduce the £2 to shillings. £2 = 40*s.*, plus 18*s.* in the dividend = 58*s.* $\frac{1}{6}$ of 58*s.* is 9*s.* and 4*s.* remaining. Write the 9*s.* in the quotient, and reduce the 4*s.* to pence. 4*s.* = 48*d.*, plus 6*d.* in the dividend = 54*d.* $\frac{1}{6}$ of 54*d.* is 9*d.*, which write in the quotient. £1 9*s.* 9*d.* is the quotient required.

NOTE.—When the divisor is a denominate number, as in Ex. 2, reduce both divisor and dividend to the same denomination, and divide as in simple numbers.

EXAMPLES.

215. *1.* Divide £13 12*s.* 3*d.* by 11; by 9; by 33.

2. How many yards of muslin at 7*d.* per yard can be bought for £5 12*s.*? For £9 9*s.*? (See note.)

3. Divide 17*s.* 3*d.* by .05; by .09; by .15.

Reduce the dividend to the decimal of a pound, then divide in the usual manner, and reduce the quotient to pounds, shillings, and pence.

4. How many yards of silk at £1 19*s.* 2*d.* per yard can be purchased for £86 3*s.* 4*d.*? (See note.)

5. Divide 85° 18′ 30″ by 15; by 18; by 27.

6. If 48 shares of a certain stock are worth £2013 8*s.*, what is the value of 1 share?

7. Divide 322 *A.* 90 *sq. rd.* by 10; by 13; by 16.

8. A pile of wood 4 *ft.* wide and 6 *ft.* high contains 18 *cd.* 72 *cu. ft.*; what is the length of the pile?

9. If 120 spoons weigh 32 *lb.* 9 *oz.* 15 *pwt.*, what does 1 weigh?

10. If 42 *yd.* of cloth cost £20 16*s.* 6*d.*, what is the price of 1 *yd.*? Of 12 *yd.*? Of 20 *yd.*?

LONGITUDE AND TIME.

216. The whole circle of the earth, or 360°, passes under the sun in 24 hours, and in 1 hour passes $\frac{1}{24}$ of 360°, or 15°; in 1 minute, $\frac{1}{60}$ of 15° (15 × 60′), or 15′; and in 1 second, $\frac{1}{60}$ of 15′ (15 × 60″), or 15″.

217. Comparison of **Longitude** and **Time.**

For a difference of	There is a difference of
15° in Longitude	1 *hr.* in Time.
15′ " "	1 *min.* " "
15″ " "	1 *sec.* " "
1° " "	4 *min.* " "
1′ " "	4 *sec.* " "
1″ " "	$\frac{1}{15}$ *sec.* " "

218. RULE.—*1. The difference in longitude of two places, expressed in ° ′ ″, divided by 15 will produce their difference in time expressed in hours, minutes, and seconds.*

2. The difference in time of two places, expressed in hr. min. sec., multiplied by 15 will produce their difference in longitude expressed in ° ′ ″.

219. TABLE OF LONGITUDES.

Albany............	73°	44′	50″	W.	New York..........	74°	0′	3″	W.
Ann Arbor.........	80°	43′		W.	New Orleans........	90°	2′	30″	W.
Boston.............	71°	3′	30″	W.	Paris...............	2°	20′	22″	E.
Berlin	13°	23′	45″	E.	Philadelphia.......	75°	10′		W.
Calcutta...........	88°	19′	2″	E.	Rome...............	12°	27′	14″	E.
Cincinnati.........	84°	29′	31″	W.	Richmond, Va......	77°	25′	45″	W.
Chicago	87°	37′	45″	W.	San Francisco......	122°	26′	45″	W.
Jefferson City, Mo...	92°	8′		W.	St. Paul, Minn.....	95°	4′	55″	W.
London............	0°	5′	38″	W.	St. Louis, Mo.......	90°	15′	15″	W.
Mexico	99°	5′		W.	Washington, D. C..	77°	0′	15″	W.

EXAMPLES.

220. Find the difference in longitude between

1. New York and London.
2. Boston and Paris.
3. Chicago and San Francisco.
4. St. Louis and Calcutta.
5. Philadelphia and Berlin.
6. San Francisco and Calcutta.

Find the difference in time between

7. New York and Greenwich.
8. Chicago and New York.
9. Richmond and Calcutta.
10. Rome and London.
11. Paris and Albany.
12. Calcutta and Jefferson City.

13. The difference in time between New York and Greenwich is 4 *hr.* 56 *min.* $\frac{1}{5}$ *sec.*; what is the difference in longitude? When it is 12 o'clock noon at New York, what is the time at Greenwich?

14. A navigator finds that when it is noon at his place of observation, it is 16 *min.* 34 *sec.* past 10 P.M. by his chronometer, Greenwich time; what is his longitude?

15. When it is 6 o'clock P.M. at Richmond, Va., what is the time at St. Louis, Mo.?

16. If the difference of time between two places is 1 *hr.* 18 *min.* 4 *sec.*, what is the difference of longitude?

17. When it is 20 *min.* past 2 P.M. at Boston, Mass., what o'clock is it at San Francisco?

18. When it is 9 o'clock P.M. in San Francisco, it is 3 *min.* $3\frac{2}{15}$ *sec.* past 11 A.M. in Calcutta; what is the longitude of San Francisco, if the longitude of Calcutta is 88° 19′ 2″ E.?

19. When it is noon in Chicago, it is 5 *min.* $29\frac{1}{5}$ *sec.* of 1 P.M. in New York; what is the longitude of Chicago, the longitude of New York being 74° 3″ W.?

THE METRIC SYSTEM.

221. In the **Metric System**, the *Meter* is the basis of all the weights and measures which it employs.

222. The **Meter** is the unit of length, and is equal to one ten-millionth part of the distance measured on a meridian of the earth from the equator to the pole, and equals about 39.37 inches.

The standard meter is a bar of platinum carefully preserved at Paris. Exact copies of the meter and the other units have been procured by the several nations, including the United States, that have legalized the system. Comparisons with the standard units are made under certain conditions of temperature and atmospheric pressure.

---

* The use of the metric system is (1878) obligatory in Belgium, France, Germany, Greece, Netherlands, Italy, Portugal, Roumania, Spain, and Switzerland; in the Argentine Republic, Brazil, Peru, San Domingo, United States of Colombia, and Uruguay—countries aggregating a population of 181,000,000—while its use is partial or legalized in Austria, Azores, Madeira and Cape de Verde Islands, Central American States, Denmark, Japan, Sweden, Norway, Turkey, Spanish Possessions, Great Britain and the British Possessions, and our own country, aggregating a population of 375,000,000 more. For the year ending June 30, 1877, the value of our imports from countries where the metric system is obligatory amounted to $177,807,469; partially in use, $17,378,785; legalized, $265,211,585; not legalized or in use, only $28,804,140. Of the amount received from countries where its use is legalized, Great Britain and British Possessions furnish $185,667,400. With these countries our present system is partly in harmony, but unfortunately the bulk of our trade with them is made up of articles measured by the bushel and gallon, neither of which standards corresponds to any bushel or gallon of this country. It should be borne in mind that the only legalized system of weights and measures in this country to-day is the metric system, and that this system is the only one we possess in harmony with that of any other country.

223. The names of the *higher* denominations, or *multiples*, of the unit are formed by prefixing to the several *units* the Greek numerals, *deka* (10), *hecto* (100), *kilo* (1000), and *myria* (10000); as *dekameter*, 10 meters, *hectometer*, 100 meters, etc.

To assist the memory, observe that the initial letters of the multiples are in alphabetical order; thus, *D, H, K,* and *M.*

224. The names of the *lower* denominations, or *divisions*, of the unit are formed by prefixing to the several *units* the Latin numerals, *deci* ($\frac{1}{10}$), *centi* ($\frac{1}{100}$), *milli* ($\frac{1}{1000}$); as *decimeter*, $\frac{1}{10}$ meter, *centimeter*, $\frac{1}{100}$ meter, etc.

To assist the memory observe that the following words are derived from the same roots: *dime, decimal, decimate, decennial,* etc.; *cent, cental, century, centennial,* etc.; *mill, millennium,* etc.

LINEAR MEASURE.

225. TABLE.

		1 Millimeter.....($\frac{1}{1000}$ of a meter)	=	.03937 *in.*
10 *mm.*	=	1 Centimeter.....($\frac{1}{100}$ of a meter)	=	.3937 *in.*
10 *cm.*	=	1 Decimeter......($\frac{1}{10}$ of a meter)	=	3.937 *in.*
10 *dm.*	=	1 METER........(1 meter)	=	39.37 *in.*
10 *m.*	=	1 Dekameter.....(10 meters)	=	32.8 *ft.*
10 *Dm.*	=	1 Hektometer....(100 meters)	=	328.09 *ft.*
10 *Hm.*	=	1 Kilometer......(1000 meters)	=	.62137 *mi.*

NOTES.—1. The meter, like the yard, is used in measuring cloths, ribbons, laces, short distances, etc.

2. The kilometer is used in measuring long distances, and is about $\frac{5}{8}$ of a mile.

3. The centimeter and millimeter are used by artisans and others in measuring minute lengths. The other denominations are rarely used.

EXAMPLES.

226. *1.* Reduce 875275 meters to kilometers.

ANALYSIS.—Since 1 kilometer equals 1000 meters, in 875275 meters there are as many kilometers as 1000 is contained times in 875275, or 875.275. To divide by 1000 place the point three places to the left (**143**, 3).

2. Reduce 675.318 kilometers to meters.

ANALYSIS.—Since 1 kilometer equals 1000 meters, in 675.318 kilometers there are 675.318 times 1000, or 675318 meters. To multiply by 1000, place the point three places to the right (**140**, note).

3. Reduce 383.64 meters to centimeters; to kilometers.

4. Reduce 175.16 centimeters to kilometers; to meters.

5. Reduce to meters and find the sum of 876.2 decimeters, 30347 centimeters, 176.48 meters, 8.175 kilometers.

6. A ship sails 5712 kilometers in 48 days; how many kilometers does she sail per day?

7. What is the value of 56.4 meters of silk at $1.75 per meter?

8. 16 pieces of cloth contain 38.5 meters each; 18 pieces contain 39 meters each; and 24 pieces contain 41.2 meters each; how many meters in all?

9. How many meters of ribbon at 27 cents per meter can be purchased for $245.70 ?

SQUARE MEASURE.

227. The unit of square measure is the *square meter.*

TABLE.

100 Square Centimeters, *sq. cm.* = 1 Square Decimeter = 15.5+ *sq. in.*
100 Square Decimeters, *sq. dm.* = 1 SQUARE METER, *Sq. M.* = 1.196+ *sq. yd.*

NOTES.—1. The square meter is used in measuring flooring, ceilings, etc.; the square decimeter and the square centimeter are used for minute surfaces.

2. Since units of square measure form a scale of hundreds, each denomination must have two places of figures.

228. The unit of **Land Measure** is the *are,* and is equal to a square dekameter (100 square meters), or 119.6 square yards.

TABLE.

1 Centare...(1 square meter) = 1550 *sq. in.*
100 Centares, *ca.* = 1 Are.......(100 square meters) = 119.6 *sq. yd.*
100 Ares, A. = 1 Hectare...(10000 square meters) = 2.471 acres.

NOTE.—The hectare is the ordinary unit for land.

EXAMPLES.

229. *1.* Write 16 *sq. m.,* 8 *sq. dm.,* 24 *sq. cm.,* having the square meter as the unit. *Ans.* 16.0824.

2. Write 83 *sq. m.,* 9 *sq. dm.,* having the *sq. m.* as the unit.

[illegible] MEASURES.

[illegible]

[illegible] how many centares?

[illegible] meters in a building lot 8 m. by 32 m.?

[illegible] lots, each containing 225 sq. m. can be [illegible] field containing 9 hectares?

[illegible] in a farm 1.02¼ Km. in width and [illegible] length.

[illegible] the cost of a mirror 2.25 m. by 1.44 m. at $3.84

[illegible] wide by 60 m. deep, or having an [illegible] from 6 hectares?

[illegible] land for $6950.50, and sold it for [illegible] he made $1.80 a hectare; how [illegible]

[illegible] carriage are 3.5 meters in circumference [illegible] 4.8 meters, how many more [illegible] than the hind wheels, in [illegible]

[illegible] MEASURE.

[illegible] solids is the *cubic* [illegible]

[illegible]

[illegible] = .061 *cu. in.*
[illegible] = 61.027 *cu. in.*
[illegible] = 35.317 *cu. ft.*
[illegible] = 1.308 *cu. yd.*

[illegible] measuring embankments, excava- [illegible] of solid bodies.

EXAMPLES.

232. *1.* Write 29 *cu. m.*, 75 *cu. dm.*, having the cubic meter as the unit. *Ans.* 29.075 *cu. m.*

2. Write 17 *cu. m.*, 218 *cu. dm.*, 27 *cu. cm.*, having the cubic meter as the unit.

3. How many cubic meters in a box 3.5 *m.* by 3.2 *m.* by 2.5 *m.*?

4. Bought 12 sters of wood; having sold 8.7 cubic meters, how much remained?

5. There are 13 blocks of marble, each containing 370.16 *cu. dm.*; how many cubic meters in all?

6. How many cubic meters in an excavation 13.2 *m.* by 18.5 *m.* by 8.4 *m.*?

7. At $1.25 a cubic meter, what will it cost to dig a cellar 6.5 *m.* long, 5.4 *m.* wide, and 2.5 *m.* deep?

8. How many sters of wood in a pile of wood 2.5 *m.* high, 2 *m.* wide, and 16.5 *m.* long? What is the length of a pile of the same height and width containing 216 sters?

DRY AND LIQUID MEASURE.

233. The unit of **Dry** and **Liquid Measure** is the *liter*, which is equal to a cubic decimeter, 1.0567 wine quarts, or .908 dry quart.

TABLE.

				Dry Measure.	Liquid Measure.
		1 Milliliter ...($\frac{1}{1000}$ of a liter)	=	.06103 *cu. in.*,	or, .0338 *fl. oz.*
10 *ml.*	=	1 Centiliter...($\frac{1}{100}$ of a liter)	=	.6103 *cu. in.*,	or, .338 *fl. oz.*
10 *cl.*	=	1 Deciliter....($\frac{1}{10}$ of a liter)	=	6.1027 *cu. in.*,	or, .845 *gi.*
10 *dl.*	=	1 LITER......(1 liter)	=	.908 *qt.*,	or, 1.0567 *qt.*
10 *l.*	=	1 Dekaliter...(10 liters)	=	9.08 *qt.*,	or, 2.6418 *gal.*
10 *Dl.*	=	1 Hectoliter..(100 liters)	=	2.8375 *bu.*,	or, 26.418 *gal.*
10 *Hl.*	=	1 Kiloliter...(1000 liters)	=	28.375 *bu.*,	or, 264.18 *gal.*

NOTES.—1. The liter is commonly used in measuring wine, milk, etc., in moderate quantities. For minute quantities the centiliter and milliliter are employed; and for large quantities the dekaliter.

2. For measuring grain, etc., the hectoliter (= 2.8375 bushels) is commonly used.

3. Instead of the kiloliter and milliliter, it is customary to use their equals, the cubic meter and cubic centimeter.

EXAMPLES.

234. *1.* How many liters in a vessel whose capacity is 1 cubic meter?

2. What is the cost of sixteen liters of milk at 8 cents a liter?

3. How many hectoliters of wheat can be bought for $396 at $5.50 per hectoliter?

4. How many hectoliters of grain can be put in a rectangular bin, 4 *m.* long, 3.5 *m.* wide, and 1.2 *m.* high?

5. How many liters in 63.5 dekaliters? In 83.75 hectoliters?

6. At $1.75 a liter, what is the cost of 85.6 dekaliters of wine?

7. How many hectoliters in 16 cubic meters?

8. How many bags, each holding 1 hectoliter, can be filled from a bin, 1.5 *m.* high, 2.4 *m.* wide, and 5 *m.* long?

9. A cistern 3.5 *m.* by 3.2 *m.*, and 9 *m.* deep, will hold how many dekaliters?

10. A merchant bought 4 hectoliters of nuts at $8.50 per hectoliter, and retailed them at 12 cents a liter; what was his profit?

WEIGHT.

235. The unit of weight is the *gram*, which is equal to the weight of a cubic centimeter of distilled water in a vacuum, at its greatest density (39.2° F.), or 15.432 grains.

TABLE.

		1 Milligram……	($\frac{1}{1000}$ of a gram)	=	.01543 *gr.* Tr.
10 *mg.*	=	1 Centigram ….	($\frac{1}{100}$ of a gram)	=	.1543 *gr.* Tr.
10 *cg.*	=	1 Decigram……	($\frac{1}{10}$ of a gram)	=	1.543 *gr.* Tr.
10 *dg.*	=	1 GRAM………	(1 gram)	=	15.432 *gr.* Tr.
10 *g.*	=	1 Dekagram…..	(10 grams)	=	.3527 *oz.* Av.
10 *Dg.*	=	1 Hectogram …..	(100 grams)	=	3.5274 *oz.* Av.
10 *Hg.*	=	1 Kilogram, or Kilo …	(1000 grams)	=	2.6792 *lb.* Tr. 2.2046 *lb.* Av.
10 *Kg.*	=	1 Myriagram…..	(10000 grams)	=	22.046 *lb.* Av.
10 *Mg.*, or 100 Kilos	=	1 Quintal …….	(100000 grams)	=	220.46 *lb.* Av.
10 *Q.*, or 1000 Kilos	=	1 Tonneau, or TON ….	(1000000 grams)	=	2204.6 *lb.* Av. 1.1023 *T.*

NOTES.—1. The above table is used in computing the weights of all objects from the smallest atom to the largest known body. The gram, kilogram (or kilo), and ton are principally used.

2. The gram is used in weighing letters, gold, silver, precious stones, and medicines.

3. The kilogram, or kilo, like the pound, is used in weighing groceries and coarse articles. It is approximately 2⅕ pounds Av.

4. The ton is the weight of a cubic meter of water, and is used in weighing very heavy articles, as coal, iron, etc.

5. The pound of Germany, Austria, and Denmark is equal to ½ of a kilogram; the centner, to 100 pounds, or ½ of a quintal.

EXAMPLES.

236. *1.* What is the weight in grams of a cubic meter of water? Of a *cu. dm.* of water?

2. A farmer sells to A 3.716*T.* of hay, to B 4.325*T.*, to C 8775 kilos; how many tons does he sell?

3. The U. S. 50-cent piece weighs 12.5 grams; how many can be coined from a kilogram of standard silver?

4. The U. S. 5-cent piece (copper and nickel) weighs 5 grams; how many 5-cent pieces are equivalent in weight to 12 50-cent pieces?

5. How much alloy must be used in making 1200 U. S. twenty-five-cent pieces? (See Art. 181.)

6. What is the cost of 75.6 kilos of sugar at 18 cents a kilo?

7. How many kilos of lard can be bought for 1248 francs at 1.04 francs per kilo?

8. How many powders, each containing 6 grams, can be made from .372 kilogram?

9. What is the weight of 10 *cu. m.* of ice, it being .93 as heavy as water?

237. SCHEME OF THE WEIGHTS AND MEASURES OF THE METRIC SYSTEM.

Ratios.	Lengths.	Surfaces.	Volumes.	Weights.
1000000				Tonneau.
100000				Quintal.
10000	Myriameter			Myriagram.
1000	Kilometer		Kiloliter	Kilogram, or kilo.
100	Hectometer	Hectare	Hectoliter	Hectogram.
10	Dekameter		Dekaliter	Dekagram.
1	METER	ARE	LITER	GRAM.
$\frac{1}{10}$	Decimeter		Deciliter	Decigram.
$\frac{1}{100}$	Centimeter	Centare	Centiliter	Centigram.
$\frac{1}{1000}$	Millimeter		Milliliter	Milligram.

238. TABLE OF EQUIVALENTS.

The equivalents here given agree with those that have been established by Act of Congress (July 28, 1866) for use in legal proceedings and in the interpretation of contracts.

1 inch = 2.54 centimeters............1 centimeter = 0.3937 inch.
1 foot = 3.048 decimeters............1 decimeter = 0.328 foot.
1 yard = 0.9144 meter...............1 meter = 1.0936 yards = 39.37 in.
1 rod = 0.5029 dekameter...........1 dekameter = 1.9884 rods.
1 mile = 1.6093 kilometers..........1 kilometer = 0.62137 mile.
1 sq. inch = 6.452 sq. centimeters...1 sq. centimeter = 0.155 sq. inch.
1 sq. foot = 9.2903 sq. decimeters...1 sq. decimeter = 0.1076 sq. foot.
1 sq. yard = 0.8361 sq. meter........1 sq. meter = 1.196 sq. yards.
1 sq. rod = 25.293 sq. meters........1 are = 3.954 sq. rods = 119.6 sq. yards.
1 acre = 0.4047 hectare.............1 hectare = 2.471 acres.
1 sq. mile = 2.59 sq. kilometers.....1 sq. kilometer = 0.3861 sq. mile.
1 cu. inch = 16.387 cu. centimeters..1 cu. centimeter = 0.061 cu. inch.
1 cu. foot = 28.317 cu. decimeters...1 cu. decimeter = 0.0353 cu. foot.
1 cu. yard = 0.7645 cu. meter........1 cu. meter = 1.308 cu. yards.
1 cord = 3.624 sters.................1 ster = 0.2759 cord.
1 liquid quart = 0.9463 liter.........1 liter = 1.0567 liquid quarts.
1 gallon = 0.3785 dekaliter.........1 dekaliter = 2.6417 gallons.
1 dry quart = 1.101 liters............1 liter = 0.908 dry quart.
1 peck = 0.881 dekaliter............1 dekaliter = 1.135 pecks.
1 bushel = 3.524 dekaliters.........1 hektoliter = 2.8375 bushels.
1 ounce av. = 28.35 grams..........1 gram = 0.03527 ounce av.
1 pound av. = 0.4536 kilogram......1 kilogram = 2.2046 pounds av.
1 pound av. = 0.9072 German pounds.1 German pound = 1.1023 pounds av.
1 ton (2000 lbs.) = 0.9072 met. ton.. 1 met. ton = 1.1023 tons = 2204.6 lb. av.
1 grain Troy = 0.0648 gram.........1 gram = 15.432 grains Troy.
1 ounce Troy = 31.1035 grams......1 gram = 0.03215 ounce Troy.
1 pound Troy = 0.3732 kilogram.....1 kilogram = 2.679 pounds Troy.

EXAMPLES.

239. 1. In 225 meters how many yards? How many inches?

2. Reduce 6 miles to kilometers; to meters.

3. Reduce 640 acres to hectares; to ares.

4. In 10 kilometers, how many feet? How many miles?

5. In 175.6 kilos, how many pounds?

6. How many German pounds in 225 English or U. S. pounds?

7. What is the weight of the U. S. standard silver dollar in grams? Of the trade dollar?

8. In 5000 U. S. bushels, how many hectoliters? How many dekaliters?

9. In 875 *cu. yd.* how many *cu. m.*?

10. In 1000 *cu. m.* how many *cu. yd.*?

11. Reduce 1728 *gal.* wine to liters; to dekaliters.

12. In 244 *sq. m.* how many *sq. yd.*? How many *sq. ft.*?

13. Reduce 220 *oz.* Av. to grams; to kilograms.

240. APPROXIMATE VALUES.

When no great accuracy is required, we may, for all practical purposes, consider—

1 decimeter = 4 inches.
1 meter = 39 inches.
5 meters = 1 rod.
1 kilometer = ⅝ mile.
1 square meter = 10¾ square feet.
1 hectare = 2½ acres.

1 cu. met. or ster = 1⅓ cu. yd., or ¼ cord.
1 liter = 1 quart.
1 hectoliter = 2⅚ bushels.
1 gram = 15½ grains.
1 kilogram = 2⅕ pounds.
1 ton = 2200 pounds.

APPROXIMATE RULES.

241. To reduce avoirdupois ounces to grams:

Multiply by 30, and then deduct one-twentieth (5 per cent.).

NOTE.—Answer too great by about 5*g.* for every 1000*g.* of the result.

242. To reduce avoirdupois pounds to kilograms:

Divide by 2, and then deduct one-tenth.

NOTE.—Answer too small by about 8 kilos for every 1000 kilos of the result. If $\frac{1}{11}$, instead of $\frac{1}{10}$, be deducted, the answer will be too great by 2 kilos for every 1000 kilos of the result.

243. To reduce avoirdupois pounds to half-kilograms, or German pounds:

Deduct one-tenth.

NOTE.—The answer by this rule will be too small by about 8 German pounds for every 1000 German pounds of the result. If $\frac{1}{11}$ be deducted, the answer will be too great by 2 German pounds for every 1000 German pounds of the result.

244. To reduce tons (2000 lbs.) to metric tons:

Deduct one-tenth.

NOTE.—The same relative error as in Art. 242.

245. To reduce yards to meters:

Deduct one-twelfth.

NOTE.—Answer too great by 2¼ *m.* for every 1000 *m.* of the result.

246. To reduce square yards to square meters:

Deduct one-sixth.

NOTE.—Answer too small by about 8 *sq. m.* for every 1000 *sq. m.* of the result.

247. To reduce cubic yards to cubic meters:

Divide by 1.3.

NOTE.—Answer too great by about 6 *cu. m.* for every 1000 *cu. m.* of the result.

248. To reduce U. S. gallons to liters:

Multiply by 4, and then subtract one-twentieth (5 per cent.).

NOTE.—Answer too great by about 4 *l.* for every 1000 *l.* of the result.

249. To reduce U. S. bushels to hectoliters:

Divide by 3, and then add one-twentieth (5 per cent.).

NOTE.—Answer too small by about 7 *hl.* for every 1000 *hl.* of the result.

250. To reduce grams to avoirdupois ounces:

Divide by 30, and then add one-twentieth (5 per cent.).

NOTE.—Answer too small by about 8 ounces for every 1000 ounces of the result.

251. To reduce kilograms to avoirdupois pounds:

Multiply by 2, and then add one-tenth.

NOTE.—Answer too small by about 2 *lb.* av. for every 1000 *lb.* av. of the result.

252. To reduce German pounds, or half-kilograms, to avoirdupois pounds:

Add one-tenth.

NOTE.—Same error as in Art. 251.

253. To reduce metric tons to U. S. tons (2000 lbs.):

Add one-tenth.

NOTE.—Answer too small by about 2 U. S. tons for every 1000 tons of the result.

254. To reduce meters to yards:

Add one-twelfth, and 1% of the original number.

NOTE.—Answer will be too small by only ¼ *yd.* for every 1000 *yd.* of the result.

This method is used at the New York Custom House and is sufficiently accurate for practical purposes.

If $\frac{1}{11}$ be added, the answer will be too small by about 2½ *yd.* for every 1000 *yd* of the result. If $\frac{1}{10}$ be added, the answer will be too great by about 6 *yd.* for every 1000 *yd.* of the result.

Ex. According to above rule, how many yards in 324 meters?

OPERATION.

$$\begin{array}{r} 324 \\ 27 \\ 3.24 \\ \hline 354.24 \end{array}$$

(Exact result is 354.33 *yd.* Error only .09 *yd.*)

255. To reduce square meters to square yards:

Add one-fifth.

NOTE.—Answer too great by about 3 *sq. yd.* for every 1000 *sq. yd.* of the result.

256. To reduce cubic meters to cubic yards:

Multiply by 1.3.

NOTE.—Answer too small by about 6 *cu. yd.* for every 1000 *cu. yd.* of the result.

257. To reduce liters to U. S. gallons:

Multiply by 2.11, and then divide by 8.

NOTE.—Answer too small by about 1.7 *gal.* for every 1000 *gal.* of the result.

Ex. In 144 liters, how many U. S. gallons?

OPERATION.

$$\begin{array}{r} 144 \\ 144 \\ 288 \\ \hline 8\,)\,303.84 \\ \hline 37.98 \end{array}$$

(Exact result should be 38.04. Error only .06 *gal.*

258. To reduce hectoliters to U. S. bushels.

Multiply by 3, and then subtract one-twentieth (5 per cent.).

NOTE.—Answer too great by about 4 *bu.* for every 1000 *bu.* of the result.

239. FOREIGN WEIGHTS AND MEASURES.

ARGENTINE CONFEDERATION.

Metric system used [illegible] the [illegible] [illegible] old Spanish weights [illegible] [illegible] are Spanish in common [illegible]

[illegible] [illegible] [illegible]

[illegible] Metric System.

[illegible]

[illegible] [illegible] legal sys- [illegible] [illegible] [illegible] [illegible] only [illegible] Spanish weights and [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] used.

[illegible] Metric System.

[illegible] [illegible] [illegible] English [illegible]

[illegible]

DENMARK.

1 Pound (½ kilogram)	=	1.102 lb. av.
1 Centner (100 lb.)	=	110.23 lb. av.
1 Tönde of grain	=	3.948 U.S. bu.
1 Tönde of coal	=	4.825 U.S. bu.
1 Fod (Foot)	=	1.03 U.S. ft.
1 Viertel	=	2.04 U.S. gal.
1 Mile (Mil)	=	[illegible]

Coinage now the metric. The introduction of complete metric system is in prospect.

ECUADOR. Metric System.

ENGLAND (see Great Britain).

EGYPT. Metric System.

FRANCE. Metric System.

The old French *aune* = 46 inches is still used to some extent in the silk industries of France and the U.S.

GERMANY.

Metric system with a few changes in subdivisions in general use.

Pound (½ kilogram)	=	1.1023 lb. av.
Centner (100 pounds)	=	110.23 lb. av.
1 Tonne (metric ton)	=	2204.6 lb. av.

GREAT BRITAIN.

Imp. Gallon	=	1.2 U.S. *gal.*
Bushel	=	1.03 U.S. *bu.*
Quarter	=	8.25 U.S. *bu.*
Imp. beer gallon	=	1.22 U.S. *gal.*
Cental	=	100 *lb.*
Quarter of Wheat at London	=	480 *lb.*
[illegible]	=	504 *lb.*
[illegible] wheat at [illegible] and other places	=	496 *lb.*

Metric system permitted by law of 1864.

GREECE.

Metric system with the common Grecian names in general use.

In the Ionian Islands the English weights and measures have been legalized since 1829.

HONG KONG, (AS CHINA.)

INDIA.

1 Seer = 16 chattacks.

1 Bombay Maund of 40 seers	=28 *lb.*av.
1 " " 42 "	=29.4 "
1 Surat " 40 "	=31⅓ "
1 " " 42 "	=39⅓ "
1 " " 44 "	=41$\frac{1}{15}$ "
1 Bengal Factory Maund	=74⅔ "
1 " Bazaar "	=82⅓ "
1 Madras Maund	=25 "
1 Bom'y Candy of 20 maunds	=560 "
1 Surat " " "	=746⅔ "
1 Madras " " "	=500 "
1 Travancore " " "	=660 "
1 Tola	=180 *gr.*
1 Guz of Bengal	=1 Eng. yard.
1 Corge	=20 units.
1 Corge Pound	=20 *lb.*

Metric system permissive.

ITALY.

1 Palm = .555 *cu. ft.*

Metric system in general use.

JAPAN.

1 Picul = 133⅓ *lb.* av.

For coinage, in part, the metric unit of weight is used.

JAVA.

1 Amsterdam Pond	= 1.09 *lb.* av.
1 Picul	= 133⅓ "
1 Catty	= 1⅓ "
1 Chang	= 4 yards.

LIBERIA.

British weights and measures generally used.

MEXICO.

Weights and measures are legally the metric, but the metric system is not generally in force, the old Spanish weights and measures (see Spain) being still employed.

NETHERLANDS.

Metric system with a change in names in general use.

1 Last (30 hectoliters) = 85.134 *bu.*

NORWAY AND SWEDEN.

1 Swedish Skalpond	= 0.93⅓ *lb.* av.
1 Swedish Centner	= 93⅓ "
1 Norwegian Pund	= 1.1 "
1 Swedish Fot	= 11.7 inches.
1 Norwegian Fod	= 12.02 "

In Norway the metric system is used to some extent.

In Sweden, the coin weight and the medicinal and apothecary weight are metric. The complete metric system is now permissive, and will be obligatory after 1882.

PERU, (AS BOLIVIA.)

PORTUGAL.

Metric system compulsory since Oct. 1, 1868.

The chief old measures are—

1 Libra	= 1.012 *lb.* av.
1 Almunde of Lisbon	= 4.42 U. S. *gal.*
1 Alquiere	= .3928 U. S. *bu.*

RUSSIA.

1 Pound	= 0.9 *lb.* av.
1 Pood (63 to a ton)	= 36 "
1 Berkowitz	= 360 "
1 Chetvert	= 5.956 U.S. *bu.*
1 Vedro	= 3.25 U. S. *gal.*
1 Arsheen	= 28 inches.
1 Ship Last	= 2 tons.

Metric system partially in use.

SIAM.

1 Tael = 1⅓ *oz.* av.

Picul, Catty, and Chang, same as Java.

SPAIN, (METRIC SYSTEM.)

In many of the South American States and in Cuba, the old Spanish weights and measures, principally Castilian, are used. They are as follows:

1 Libra = 1.014 *lb.* av.
1 Arroba (25 Libras) = 25.36 "
1 Quintal (100 Libras) = 101.44 "
1 Vara = .914 *yd.*

SWITZERLAND.

Metric system used with some changes of names and subdivisions. Pure metric system optional.

TURKEY, (METRIC SYSTEM.)

URUGUAY, (AS ARGENTINE CONFEDERATION.)

VENEZUELA, (METRIC SYSTEM.)

REVIEW EXAMPLES.

260. *1.* How many days from Mar. 16 to Oct. 4? From June 30 to Dec. 25?

2. Find the time by compound subtraction from Aug. 23, 1882, to Jan. 15, 1884.

3. How many leap years from 1881 to 1897? From 1795 to 1845? From 1889 to 1909?

4. Reduce 2.375 years to years, months, and days.

5. Suppose a person's income to be $1000 per day, how much is that per minute?

6. How many chains in one mile?

7. In 4376 feet how many chains? How many inches?

8. In 396 rods, how many chains? How many feet?

9. In 37.56 chains, how many feet? How many rods?

10. Children's size 1 of shoemakers' measure is 4⅛ inches long; what is the length of boys' size 8, youths' size 1, and men's size 10? (Size 1 of the second series is one size longer than size 13 of the first series. See Art. 157.)

11. How many square feet in a rectangular lot, whose breadth is 25¾ feet and whose length is 116½ feet?

12. How many square feet in a lot 25 feet front and 100 feet deep?

13. How many acres in a rectangular field, 28.50 chains by 46.38 chains?

14. How many acres in a rectangular piece of land, 224 links by 448 links?

15. How many acres in a square lot whose side is 316¼ links? 208.71 feet?

16. How many square yards in a floor, 16 *ft.* 6 *in.* by 12 *ft.* 9 *in.*?

17. How much will it cost to carpet a floor 16 *ft.* by 18 *ft.*, with carpeting ¾ *yd.* wide, at $1.60 per yard?

18. What is the value of a field 320 *rd.* long and 160 *rd.* wide at $22.50 an acre?

19. A rectangular lot contains 24 acres: what is its width, its length being 1056 feet?

20. How much will it cost to dig a cellar 36 *ft.* long, 30 *ft.* wide, and 6 *ft.* deep, at 30 cents per cubic yard?

21. If a pile of bark is 40 *ft.* long and 4 *ft.* wide, how high must it be to contain 10 cords?

22. How many feet, board measure, in 16 boards each 18 *ft.* long, 10 *in.* wide, and 1 *in.* thick?

23. How many feet, board measure, in 12 planks, each 10 *ft.* long, 12 *in.* wide, and 2 *in.* thick?

24. How many board feet in 225 cubic feet?

25. What is a pile of wood, 19 *ft.* long, 11 *ft.* 5 *in.* high, and 8 *ft.* 7 *in.* broad, worth, at $5.62½ per cord?

26. Paid $222.75 for boards at $13.50 per M.; how many feet were purchased?

27. What is the value of 27315 *ft.* of lumber at $12 per M.?

28. How many pills, each containing 5 grains, can be made from 1 *lb.* av. of quinine?

29. In 70 *oz.* Tr., how many *oz.* av.?

30. In 70 *lb.* Tr., how many *lb.* av.?

31. What is the cost of 11 *T.* 12 *cwt.* of "Nut" coal at $6.95 per ton, and 9 *T.* 16 *cwt.* of "Chestnut" coal at $6.25 per ton?

32. What is the freight of 16 *T.* 17 *cwt.* 25 *lb.* at $5 per ton (2240 *lb.*)?

33. What is the cost of 15669 pounds meal at $1.10 per *cwt.*?

34. What cost 16450 pounds of hay at $15.50 per ton?

35. In 27318 pounds of corn, how many bushels? What is the value of the same at 48¾ cents per bushel?

36. What is the value of 27318 pounds of corn, at 87.1 cents per cental?

NOTE.—Examples 35 and 36 illustrate the present and the cental systems of buying and selling produce, and show the calculations saved by using the latter.

37. In 7346 pounds of oats, how many bushels?

38. What is the cost of 273 11/32 *bu.* oats, at 58 *c.* per bushel?

39. What is the value of 281 *lb.* peas at $1.05 per bushel?

[illegible] What is the value of 291 *lb.* of peas at $1.75 per cental?

[illegible] What is the value of 186 *lb.* of beans at $2.25 per bushel?

[illegible] What is the cost of 192 *lb.* of beans at $3.75 per cental?

[illegible] At what price per bushel is rye at $1.227 per cental? Oats at $1.66 per cental? Barley at $2.126 per cental? Malt at $3.75 per cental?

[illegible] How many bushels in 27316 pounds of wheat? In 24375 pounds of corn? In 16218 pounds of oats? In 21412 pounds of barley? In 1[illegible]3[illegible] pounds of malt?

[illegible] How many bushels in 54 centals of wheat? In 87 centals of corn? In 4[illegible] centals of oats? In 53 centals of barley? In 67 centals of malt?

[illegible] How much per cental is wheat at $1.55¼ per bushel? Corn at [illegible] cents per bushel? Oats at 48¾ cents per bushel? Barley at [illegible] cents per bushel?

[illegible] How much per bushel is wheat at $2.27 per cental? Corn at $[illegible] per cental?

[illegible] How much per cental is timothy seed at $2.75 per bushel? [illegible] $[illegible] per bushel?

[illegible] [illegible] the cost of [illegible] bushels [illegible] at 43 cents per bushel, [illegible] bushels corn at 40 cents per bushel?

[illegible] [illegible] master purchased [illegible] pounds of corn, at 31¼ cents per [illegible] pounds of oats at 32¾ cents per bushel: [illegible] hay at $22.37½ per ton (2000 pounds). What [illegible] purchase?

[illegible] [illegible] pounds of corn, at [illegible] cents per cental [illegible] oats at [illegible] cents per cental: and 38650 [illegible] per cental. How much was realized from [illegible]

[illegible] paper [illegible]

[illegible] was worth $2.28 in currency, what [illegible] dollar in gold?

[illegible] respectively are [illegible]

[illegible] would be required [illegible] How much

[illegible] double-eagles, [illegible] eagles, and 1382 gold [illegible]

57. What is the value of an *oz.* Tr. of standard gold, making no allowance for the alloy and coinage? Of an *oz.* av.?

58. What is the value of an *oz.* Tr. of pure gold, making no allowance for the alloy and coinage? Of an *oz.* av.?

59. Feb. 26, 1879, the Nevada Bank of San Francisco sold 100,000 ounces of pure silver to the United States, at 1.08\frac{1}{2}$ per ounce. At this rate, what is the intrinsic gold value of the standard silver dollar?

60. The coinage at the mints of the United States during the fiscal year ending June 30, 1879, was as follows:

GOLD—Double-eagles, $57,234,340; eagles, $1,031,440; half-eagles, $1,442,130; three-dollars, $109,182; quarter-eagles, $1,166,800; dollars, $3,020; total gold, $———.

SILVER—Dollars, $27,227,050; Half-dollars, $225; quarter-dollars, $112.50; dimes, $45; total silver, $——.

MINOR COINAGE—5-cents, $1,175; 3-cents, $984; cents, $95,639; total minor coinage, $———.

How many pieces were coined and what was the total value of the coinage?

61. Add £27 16*s.* 10*d.*, £6 10*s.* 8*d.*, £47 15*s.* 11*d.*, £25 7*s.* 6*d.*, £3 14*s.* 8*d.*, and £23 16*s.* 3*d.*

62. In 47 guineas, how many shillings and pounds?

63. What is the value of 45000 tons of steel rails at 97*s.* 6*d.* per ton? What is the value per ton in U. S. money? Of total in U. S. money?

64. How many yards of cloth at 3*s.* 6*d.* per yard can be bought for £7?

65. Reduce £19 16*s.* 9*d.* to the decimal of a pound.

66. If £1 sterling is worth $4.87, what is the value of £225 18*s.* 6*d.*?

67. From £16 12*s.* 9*d.* deduct .05 of itself.

68. What is the value of 20 *yd.* silk at 10*s.* 6*d.* per yard?

69. If 1 franc is worth $.193, what is the value of $1 in francs?

70. What is the value in U. S. money of 875 Napoleons? (1 Napoleon = 20 francs.)

71. What is the cost of 50 meters silk at 8.25 francs (8 francs 25 centimes) per meter?

72. What is the value in U. S. money of 24000 marks?

73. What is the value in U. S. money of 5,528,364 Brazilian reis? Of 7387 Portuguese milreis?

[illegible]4. In 8375 pies (money of India), how many annas and rupees?

[illegible]5. What is the value in dollars of 500 Russian poods of rye at [illegible]5 copecks per pood?

[illegible]6. The gold yen of Japan contains 1½ grams of fine gold and weighs 1⅔ grams. What is its fineness, and what is its intrinsic value compared with the U. S. gold dollar? How many yens can be coined from 10 grams of Japanese standard gold?

[illegible]7. The difference in the local time of two places is 3 *hr.* 18 *min.* 12 *sec.*; what is the difference in longitude?

[illegible]8. When it is 4 *hr.* 10 *min.* A.M. at Chicago, what is the time at Calcutta?

[illegible]9. How many bushels will a box 10 ft. long, 5 ft. wide, and [illegible] ft. high contain?

NOTE.—Since a bushel is about 1¼ cubic feet, the following approximate rules may be used for all practical purposes:

To reduce cubic feet to bushels: *Deduct one-fifth.*

The result will be too small by about 4½ bushels for every 1000 bushels of the result.

To reduce bushels to cubic feet: *Add one-fourth.*

The result will be too great by about 4½ cubic feet for every 1000 cubic feet of the result.

[illegible] examples with exactly and approximately, and compare the results.

[illegible] hectoliters of grain will a box 4 meters long, [illegible] wide, and [illegible] meters high contain?

[illegible] gallons of water will a cistern hold which is [illegible] wide, and [illegible] ft. deep?

[illegible] capacity in liters of a cistern 25 meters long, [illegible] and 3 meters deep?

[illegible] how many yards?

[illegible] per square [illegible]

[illegible] how many square deci-[illegible]

[illegible] what is the [illegible]

[illegible] per gallon; what [illegible]

[illegible] per pound; what [illegible]

PERCENTAGE.

261. Percentage is a term applied to all operations in which 100 is used as the basis of computation.

It is also the name given to any number of hundredths of a number.

262. Per Cent. (%) is an abbreviation of the Latin *per centum*, meaning *on* or *by the hundred.*

Thus, 5% means 5 of every hundred, or 5 hundredths ($\frac{5}{100}$, or .05).

263. Any *per cent.* may be expressed in the form of a *decimal* or *fraction.*

Thus 5 *per cent.* = 5% = 5 hundredths = .05 = $\frac{5}{100}$ = $\frac{1}{20}$. The first two forms are used in the statements of questions; the others in the operations.

264. In percentage, three elements are considered, viz: the *Base*, the *Rate*, and the *Percentage.* Any two being given, the other can be found.

265. The **Percentage** is the result obtained by taking a certain number of hundredths of a number.

266. The **Base** is the number of which a certain number of hundredths are taken.

267. The **Rate** is the number of hundredths, or the number per cent.

Thus, in the statement, 6% of 300 is 18, the Percentage is 18, the Base 300, and 6 per cent. (.06) is the Rate.

268. Applications of Percentage.—The principles of percentage are applied to many of the most common business transactions. Among the most important of these are Trade Discounts, Commission, Insurance, Profit and Loss, Duties, Interest, and Exchange.

[illegible]. Ex. What is 5 per cent. of 300?

[illegible] ANALYSIS.—5% is equivalent to 5 hundredths ($\frac{5}{100}$, or .05). 5 hundredths of a number may be found by multiplying it by 5 hundredths. For convenience, the multiplication is performed by expressing the 5 hundredths in the form of a decimal. .05 × 300 = 15, the percentage. Therefore the Percentage is the product of two factors, the Base and the Rate.

[illegible] 300 [illegible] and 5% [illegible] 5 times 3, or 15.

[illegible] per cent. of what number?

[illegible] ANALYSIS.—In this example there is given the Percentage and [illegible] the Base. Since the Percentage = the Base × the Rate, the Base = the Percentage ÷ the Rate.

[illegible] a certain number. 1% is ⅕ of 15, or [illegible] number [illegible] 100 times 3, or 300.

[illegible] what per cent. [illegible] 300?

[illegible] ANALYSIS.—The Base and Percentage are given, [illegible] the Rate. Since the Percentage = the Base × the Rate, the Rate = the Percentage ÷ the Base. [illegible] ÷ 300 = .05, 5%, the required per cent.

[illegible]

[illegible]

[illegible] ANALYSIS.—Multiply the number of each denomination [illegible] in the margin, and then reduce the [illegible] to integers of lower denominations [illegible].

[illegible] shillings and pence to the decimal of [illegible] Ex. 7, Art. 304), take the re[illegible] the decimal result to [illegible]. Thus,

[illegible] = £[illegible]

[illegible] = £[illegible] 18s. 1.68d.

[illegible] following

[illegible] P = 3.

[illegible] multiply the

2. To find the base, divide the percentage by the rate expressed decimally.

3. To find the rate, divide the percentage by the base.

NOTE.—In finding the rate, to produce a quotient of hundredths, make the decimal places of the dividend exceed those of the divisor by 2.

272. When the rate is an aliquot part of 100, it is generally more convenient to use the equivalent fraction. Thus,

50% = .50 = ½.
33⅓% = .33⅓ = ⅓.
25% = .25 = ¼.
20% = .20 = ⅕.
16⅔% = .16⅔ = ⅙.
12½% = .12½ = ⅛.
10% = .10 = $\frac{1}{10}$.
8⅓% = .08⅓ = $\frac{1}{12}$.
6¼% = .06¼ = $\frac{1}{16}$.
5% = .05 = $\frac{1}{20}$.
3⅓% = .03⅓ = $\frac{1}{30}$.
2½% = .02½ = $\frac{1}{40}$.

EXAMPLES.

273. What is

1. ¼ of 1728 ?
2. $\frac{25}{100}$ of 2456 ?
3. .25 of 5280 ?
4. 25% of 8424 ?
5. ⅛% of 1000 ?

Find

6. 16% of $375.
7. 8% of $24.25.
8. 2½% (¼ of 10 %) of 876. ✓
9. 7½% (10%—¼ of 10%) of $1678.
10. ¾% (1 % — ¼%) of $21275.

11. What is the difference between 2½% of $16000 and 5% of $8475 ?

12. A merchant bought goods amounting to $375.60, and sold them so as to gain 30% of the cost; how much did he gain ?

13. A lawyer collected $2875, and charged 5% for his services; how much did he retain for his services, and how much did he pay over ?

14. What is the duty on twelve watches valued at $75 each, at 25% of the value ?

15. Jan. 10, a merchant buys a bill of goods amounting to $876.40 on the following terms: 4 months, or less 5% if paid in 10 days. How much would settle the bill Jan. 18 ?

16. The product of two factors is 75 ; if one of the factors is .03, what is the other factor ?

17. The percentage is 60, and the rate 2½% ; what is the base ?

18. $18.08 are 5% of what ?
19. $324 are 3% of what ?
20. $37.56 are 2½% of what ?
21. $17.28 are 24% of what ?

22. 165 *ft.* are 33⅓% of what ?
23. £240 are 3⅓% of what ?
24. $12.25 are 6⅛% of what ?
25. 96 francs are ⅘% of what ?

269. Ex. What is 5 per cent. of 300?

OPERATION.
300 Base.
.05 Rate.
15.00 Percentage.

ANALYSIS.—5% is equivalent to 5 hundr .05). 5 hundredths of a number may be fo tiplying it by 5 hundredths. For convenie tiplication is performed by expressing the in the form of a decimal. $.05 \times 300 = 15$, th required. Therefore, the Percentage is the product of two fact and the Rate.

Or, 1% of 300 is 3, and 5% is 5 times 3, or 15.

Ex. 15 is 5 per cent. of what number?

OPERATION.
Rate. Percentage.
.05) 15.00
Base. 300.

ANALYSIS.—In this example there is g centage and Rate, to find the Base. Since the the Base × the Rate, the Base = the Perc Rate.

Or, if 15 is 5% of a certain number, 1% 3; and the number, or 100%, is 100 times 3, or 300.

Ex. 15 is what per cent. of 300?

OPERATION.
Base. Percentage. Rate.
300) 15.00 (.05

ANALYSIS.—The Base and Percenta to find the Rate. Since the Percentag × the Rate, the Rate = the Percentag $15 \div 300 = .05$ (5%), the required per

Or, 15 is $\frac{15}{300}$ or $\frac{1}{20}$ of 300. $\frac{1}{20} = \frac{5}{100}$, or 5%.

Ex. What is 4% of £247 13*s.* 6*d.*?

OPERATION.

£	*s.*	*d.*
247	13	6
		.04
£ 9.88	.52	.24
20		
s. 18.12		
12		
d. 1.68		

ANALYSIS.—Multiply the number of ination by .04, as in the margin, and th decimal parts to integers of lower d (201).

Or, reduce shillings and pence to t a pound (see note, Ex. 7, Art. 204), quired per cent., and reduce the deci lower denominations. Thus,

£247 13*s.* 6*d.* = £247.675
£247.675 × .04 = £9.907 = £9 1

270. These principles may be expressed by th formulæ:

$$P = B \times R;\quad B = P \div R;\quad R = P \div$$

271. RULES.—*1. To find the percentage, mu base by the rate expressed decimally.*

re [illegible] what ?

f what ?

26. An agent sells a house and lot for $16450, and receives 5% for his services: what does he pay to the owner of the property?

27. Mr. A invests 42% of his capital in real estate, and has $53070 left; what is his capital?

28. If a man fails to pay his tax until he is charged 8% additional, how much will he lose if his tax is $36.75?

29. If the rate is 20% and the percentage 440, what is the base?

30. A has 35% of his property invested in stocks, 10% in horses and cattle, 18% in grain, and the remainder, which is $24235, in real estate. What is the total value of his property?

31. A merchant, failing in business, pays 43% of his indebtedness; he owes A $3750, and B $6280; how much does he pay each?

32. The product of two numbers is 375; if one of the numbers is 30000, what is the other number? Express answer in hundredths.

33. The assets of a bankrupt are $27387, and his liabilities $83161; what % of his indebtedness can he pay?

What per cent. of

34. 375 is 75?
35. $1728 is $144?
36. $3456 is $72?
37. 5280 ft. is 165 ft.?
38. $1000 is $12.50?
39. $3720 is $232.50?
40. $2416 is $60.40?
41. $1484 is $21.20?

42. A merchant paid for goods $345 and sold them for $258.75: the loss is what % of the cost?

43. If a paymaster receives $150000 from the treasury, and fails to account for $225 thereof, what is the percentage of loss to the government?

44. Total imports and exports carried in foreign vessels during the fiscal year 1858, were valued at $160,666,267: in American vessels for the same time, $447,191,304. What per cent. were carried in American vessels? In foreign vessels?

45. $640 being increased by a certain % of itself equals $720: required the rate %.

46. A commission merchant sold 450 barrels of flour at $5.30 per barrel: how much should he send to the miller, if he charges 2½ per cent. for making the sale?

47. A horse was sold for $658, which was 16⅔% more than it cost; what was the cost?

NOTE.—The cost of the horse was $\frac{100}{100}$, or 100% of itself; since the gain was 16⅔% of the cost, the selling price (the cost plus the gain) was 116⅔% of the cost. $658 is 116⅔% of what number?

What number increased by

48. 25% of itself is 500?
49. 8% of itself is $1004.40?
50. 125% of itself is 999?

What number decreased by

51. 5% of itself is $307.80?
52. 40% of itself is 3726?
53. 25% of itself is $342.60?

54. When the premium on gold was 17⅜%, what amount of gold was it necessary to sell to pay a note of $3000 in currency?

55. What is 116% of 1200?

56. 144 is 120% of what number?

57. 375 is what % of 300?

58. Find 95% of $1260.

59. Of what number is 275, 100%?

60. $187.50 are 2½% of what?

61. Total imports and exports carried in foreign vessels for the fiscal year, 1879, were valued at $911,269,232; in American vessels for the same time, $272,015,697. What per cent. were carried in American vessels?

62. The total tonnage entered at ports of the United States during the year ended June 30, 1879, was 13,768,137 tons. What per cent. was entered at the port of New York? (See Ex. 64.)

63. The tonnage entered at the four ports of New York, Baltimore, Philadelphia, and Boston, for the year ended June 30, 1879, was 10,489,660 tons. This amount constituted what per cent. of the total tonnage entered at ports of the United States? (See Ex. 62.)

64. The total tonnage entered at New York during the year ended June 30, 1878, was 5,545,026 tons; during the year ended June 30, 1879, 6,661,825 tons. What was the increase per cent.?

65. The earnings of the Chesapeake and Ohio R.R. Co. for the month of July, 1878, were $14,026,189; for the month of July, 1879, $17,338,273. What was the per cent. of increase?

66. Find 5% of £375.
67. Find 2½% of £64 16*s.*
68. Find 4% of £75 12*s.* 6*d.*

69. Find 10% of £37 8*s.* 9*d.*
70. 16*s.* is 2½% of what?
71. £1 8*s.* 4*d.* is 4% of what?

34678

DISCOUNTS.

274. It is customary in many branches of business for manufacturers and dealers to have fixed price-lists of certain kinds of merchandise; and when the value changes, instead of changing a long price-list, the rate of discount is changed. The fixed price is called the *List-Price,* and the discount allowed the *Trade Discount.*

Books are usually sold by publishers and jobbers at certain discounts from the retail prices.

275. Many kinds of merchandise are sold at "time" prices, subject to certain rates of discount if paid at an earlier period.

1. Thus, the following or similar announcements are usually found upon the bill-heads of wholesale dealers: "Terms, 4 months, or 30 days, less 5%"; or, "Terms 60 days, or 1% discount in 30 days, or 2% discount in 10 days."

2. In the same business house, certain goods are sold on long credit, and others on short credit.

3. When no rate of discount has been offered, merchants are generally willing, when bills are paid before maturity, to deduct the interest on the amount of the bill for the remainder of the time at the legal rate per annum.

Ex. The list-price of a scale is $80; what is the net price if a discount of 25% and 10% is allowed?

OPERATION.

$80 List-price.
20 25%, or $\frac{1}{4}$.
60
6 10%, or $\frac{1}{10}$.
54 Net-price.

ANALYSIS.—The first rate of discount is reckoned upon, and deducted from the list-price, and the others are deducted from the successive remainders.

The result is not affected by the order in which the discounts are taken. A discount of 25% and 10% is the same as a discount of 10% and 25%.

EXAMPLES.

276. *1.* The gross amount of a bill of shoes is $82.68. What is the net amount, the rate of discount being 5%?

2. A stove is sold for $45 less 30%; required the net price?

NOTE.—If the discount is not required, multiply by .70 (100% − 30%); the product will be the net price.

3. What is the value of 466 *lb.* O.W. casing @ 45 *cts.* per pound, less 1½ per cent.?

4. The gross amount of a bill of mdse. is $106.36; what is the net amount, the rates of discount being 20% and 10%?

5. The gross amount of a bill of notions is $49.75; what is the net amount, the rates of discount being 10% and 10%?

6. What is the value of 12 pair shoes @ $1.60 per pair, less 5%?

7. What direct discount is equivalent to a discount of 15% and 10%? 45% and 10%? 20% and 12½%? 60% and 10%? 75% and 12½%?

8. What is the net value of one case prints containing 2273 *yd.*, @ 4^3 *cts.*, less 5%, cooperage 25 *cts.*?

9. A bill of merchandise amounting to $442.38 was bought Aug. 18, 1879, on the following time: "4 months or 5% off 30 days." How much would settle the bill Sept. 16, 1879?

10. What is the net value of a bill of iron amounting to $1103.75, at a discount of 45, 10, and 2 per cent.?

11. What is the net value of 1 case prints containing 3039^2 *yd.* @ 5 *cts.* per *yd.*, less a discount of 3%; cooperage $.25?

12. The net amount of a bill of files was $36.75; what was the gross amount, the rate of discount being 10%?

13. Mr. A. is offered dress goods at 26 *cts.* per *yd.*, "4 months, or less 6% cash"; how many yards can he purchase for $49.82?

14. The net amount of a bill of hardware is $175.26; what is the gross amount, the rate of discount being 45% and 10%?

15. What is the difference on a bill of $875 between a discount of 40% and a discount of 30% and 10%?

16. A bill of tinware is sold at the following discounts: $74.20 at 20% and 10%; $43.75 at 40% and 5%; $69 at 33⅓% and 10%; and $49.17 net. What is the total net amount of the bill?

17. A bill of dry goods amounting to $914.37 is sold, Aug. 19, on the following terms: "60 days, or less 1% if paid in 30 days, or less 2% if paid in 10 days." How much would settle the bill Sept. 18? How much Aug. 27?

18. Of a bill of hardware, $61.51 are sold at a discount of 60 and 5%; $18.75 at a discount of 10%; $16.86 at a discount of 12½%; $44.25 at a discount of 40 and 5%; $29.60 at a discount of 40, 12½, and 10%; $28.04 at a discount of 55%; $16 at a discount of 65, 10, and 10%; $18.70 at a discount of 50%; $19.75 at a discount of 20%; $18.50 at a discount of 15%; $307.55 at a discount of 75 and 12½%; $36.61 at a discount of 60 and 10%; and $218.25 net. What is the total net amount of the bill?

[illegible] statement of merchandise sold, or [illegible] merchandise state the place and [illegible] of the buyer and seller, the terms of [illegible] distinguishing marks and num[illegible] and other details.

[illegible] are used by many interchangeably. The term [illegible] particularly to statements rendered by consignees to [illegible] marks, numbers, values, and accrued charges [illegible] rendered to jobbers; and to bills received from for[illegible]

[illegible]MPLES.

[illegible] and extend the following bills:

[illegible]nned Goods.)

[illegible]MINGTON, DEL., Nov. [illegible]

[illegible] of JAMES MORROW & SON.

[illegible]

(3. Storage, etc.)

BROOKLYN, N. Y., *Jan. 30, 1879.*

BARK ENTERPRISE,

To J. P. & G. C. ROBINSON, *Dr.*

Terms Cash.

Storage - - - - -	16319^{23}	bu.	@	¾¢	122	39		
Elevating - - - - -	16319^{23}	"	@	½¢	**	**		
Delivering - - - - -	16319^{23}	"	@	½¢	**	**		
Weighing - - - - -	16319^{23}	"	@	½¢	**	**		
Carting - - - - - -	16319^{23}	"	@	1¢	***	**		
Loading ship - - -	16301^{34}	"	per M.	$$7^{00}$	***	**		
Separating damage -	16301^{34}	"	@	½¢	**	**		
Blowing on delivery -	16301^{34}	"	@	¼¢	**	**		
Weighing on " -	16301^{34}	"	@	½¢	**	**	***	**

(4. Provisions.)

CLEVELAND, O., *Oct. 9, 1876.*

Messrs. L. C. MAGAW & SON,

Bought of J. P. ROBISON & Co.

Terms Cash.—*No goods sold on 30 days.*

10	Bbls. S. M. Pork - - - - - - - -					17^{00}	***			
5	" Mess Beef - - - - - - - -					10^{15}	**	**		
5	" Hams	90^a	1376^b	-98^c	$*****^d$	14¢	***	**		
3	" Shoulders	58	744	−57	***	9¢	**	**		
1	" Dr. Beef	33	241	−22	***	14¢	**	**		
1	Tc. Lard		406	−60	***	11¢	**	**	***	**

^{a}Number of pieces. ^{b}Gross weight. ^{c}Tare, or weight of barrel or tierce. ^{d}Net weight.

(5. Fish.)

GLOUCESTER, MASS., *Sept. 28, 1876.*

Messrs. DANIEL WEIDMAN & Co.,

Bought of CLARK & SOMES.

Subject to sight draft without notice after thirty days.

2	Qtl. New Geo. Cod - - - - - -	5.75	**	**		
1	Bbl. Ex. $1 Mackerel - - - - - -	20.00	**	**		
10	Kits 15 lbs. Ex. $1 Mackerel - - -	1.80	**	**		
10	" 20 lbs. Bay $1 " - - -	1.80	**	**		
2	Bbls. $2 Shore " lg. - -	12.00	**	**		
10	Kits 20 lbs. $2 Shore " " - -	1.50	**	**		
5	Halfs New Labrador Herring - - -	3.82	**	**		
3	" Round Shore " - - -	2.95	*	**		
	Box $^{.38}$, ctg. in Boston $^{.90}$		*	**	$****	**

Groceries

New York Feb. 1. 1880.

H K & F B Thurber & Co.

In ordering goods same as had before, give ... and the Order and Day Book pages.

Prunes 1544 — 134 = **** lbs.		.47	**	**
Old Muscatel Raisins		[illegible]	**	**
[illegible]		[illegible]	**	**
[illegible]		[illegible]	**	**
Tartar ...	20 lbs.	.39		**
Cakes 3 doz cs.	6 doz.	.65		**
Pepper		.16		
... 21		[illegible]		
				15
Mustard	[illegible]	.25		
[illegible]		[illegible]		
...age on all				

Groceries.

New York

Austin, Nichols & Co.

(8. Dry Goods.)

NEW YORK, *March 20, 1879.*

Messrs. FIELD, LEITER & CO.,

Bought of H. B. CLAFLIN & CO.

Terms Cash in 30 days less 5%, or 4 months' note delivered within 30 days, and payable at Bank in New York exchange.

2875	1	Bale Boott M. Brown - - - - -	800	06^3	54	
8039	1	“ Continental C. do. - - - - -	800	07^1	**	
3369	1	“ Pequot A. 36 in. - - - - -	967	07^2	**	**
1290	1	“ Great Falls E. - - - - - -	1111	07^1	**	**
1590	1	“ Atlantic H. - - - 1038 - .07^3	$ **	**		
		Less 4% -	*	**	**	**
6888	1	“ Boott F. F. - - - - - - -	800	07^1	**	
2179	1	“ Pepperell 600 Drill - - - -	622	07^3	**	**
2507	1	Case Blackstone A. A. - - - - -	1649	07^1	***	**
6515	1	“ Dwight Anchor - - - - - -	1139	09	***	**
2985	1	“ Great Falls Q. - - - - -	1492	08	***	**
1650	1	“ Pearl River Ticking - - - -	708	15^3	***	**
		Cooperage -				75
					***	**

(9. Dry Goods.)

NEW YORK, *March 23, 1878.*

Messrs. DAVIDGE, LANDFIELD & CO.,

Bought of TEFFT, GRISWOLD & CO.

2	Naumkeag Bl. Jean - -	48 47	95	09	8	55
4	Roll Cambric - - - -	46 46 40^1 46	****	05^2	*	**
3	Pepperell Drill - - - -	47^3 30^1 44^3	****	08	*	**
1	Lowell $^{10}/_4$ Brown - -	- - - - -	38	14^2	*	**
3	Continental C. - - - - -	40 40 40	***	07^3	*	
5	New Market N. - - -	45^3 45 45^1 58^1 46^3	****	06^1	**	**
2	Champion Cheviot - -	48^1 50^1	***	09	*	**
2	Otis B. B. Dk Stripe - -	57^3 57^1	***	10	**	**
1	Hamilton 30 in. Tick	- - - - -	48^3	11^2	*	**
2	Thorndike C. - - - - -	58^3 61	****	08^2	**	**
2	Wamsutta C. Blea. - -	58^1 68^1	****	12	**	**
8	Andros L. - - -	52 52 49 51^1 51^3 51^3 51 52^3	***	07^3	**	**
1	Pepperell $^{10}/_4$ - - - - - - - - -		36^3	22	*	**
					***	**
	Cooperage -				1	25
					***	**

(O. Dry Goods.)

[illegible] New York, March 30, 1878.

[illegible] Milwaukee, Wis.

Bought of H. B. Claflin & Co.

[illegible] discount in 30 days, or 2%
[illegible] Exchange allowed.

[illegible] Cotton Prints [illegible]

[illegible]

[illegible]

[illegible]

(12. Hosiery.)

Claims for Damages or Errors must
be made on receipt of Goods.

New York, *June 28, 1880.*

Messrs. John Ford, Sons & Co.,

Bought of James Talcott.

Net 30 Days.
Note to your own order
Payable at a Bank in New York City.

1789	35	Doz. 3458 Mixed ½ Hose - -	.80	28			
	25	" 2032 Fancy " " - - -	.80	**			
	12	" 853 Col'd " - - -	1.00	**			
	12	" 1691 Fancy " - - -	1.00	**			
	18	" 1759 " " - - -	.75	**	**		
	20	" 1713 " " - - -	1.00	**			
	16	" 1716 " " - - -	1.10	**	**		
	6	" 3438 Fch mx ½ " - - -	.90	*	**		
	22	" Job Misses " - - -	.75	**	**	$***	**
		Shipped per P.R.R.& C.B. & Q.R.R.					

(13. Books.)

Chicago, Ill., *May 7, 1878.*

Mr. John Berwold,

Bought of Hadley Bros.

Terms Cash.

12	Randall's Arithmetics, Part 1 -	.60	7	20		
18	" " " 2 -	.50	*			
24	Smith's Primers (paper) - - -	.06	*	**		
36	" Spellers - - - - - - -	.22	*	**		
18	" 2d Readers - - - - - -	.45	*	**		
12	" 3d " - - - - - -	.70	*	**		
6	" 4th " - - - - - -	1.15	*	**		
6	" 5th " - - - - - -	1.35	*	**		
6	Doz. Brown's Copy Books - - -	1.80	**	**		
			**	**		
	Less 33⅓ % -		**	**	**	**
6	Jones' Geographies #1 - - - -	.35	2	10		
6	" " 2 - - - -	.63	*	**		
6	" " 3 - - - -	1.10	*	**		
6	" " 4 - - - -	2.00	**			
			**	**		
	Less 25 % -		*	**	**	**
3	Boxes Chalk Crayons - - - -	.18				**
3	Doz. Blank Copy Books - - -	.50			*	**
					$**	**

14. Hardware

PHILADELPHIA, [illegible] 1888.

Messrs. [illegible] RUTTER, SON, & Co.,

Bought of [illegible] 61

Terms [illegible]

[illegible] W. W. [illegible] Balusters [illegible] 318

[illegible] 080

[illegible] S. B. K. [illegible] 1840 [illegible]

Carriage Bolts [illegible]

[illegible]

35 & 12½%

Machine Bolts [illegible] 5 [illegible] 70

15.10 [illegible] 26.00

[illegible] 10½

[illegible] & 10%

[illegible] Cases Packing and Cartage

15. Watches and Jewelry

NEW YORK, [illegible] 1887.

Mr. [illegible]

Bought of WHEELER, PARSONS & HAYES

[illegible] Exchange [illegible] New York

[illegible]

Gold

[illegible]

(16. Tinware.)

Rochester, N. Y., *Oct. 16, 1880.*

Messrs. McCarthy & Redfield,

Bought of John H. Hill.

Terms 60 days. If paid in 10 days 2 per cent. discount.

	2	Doz. $21 Pieced Dish Pans - -	8.25	**	**		
	½	" 9 in. Wash Boilers - - -	36.00	**			
	3	" Pieced Bread Pans 3 x 9 x 3 -	2.00	*			
	3	" " " " 5 x 9 x 2 -	2.00	*			
	1	" $5 Pieced Covered Pails -		2	50		
	3	" $13 " Cups - - - -	.90	*	**		
	1	" $15 " Dippers - - -		1	25		
	2	" $25 " " - - -	1.75	*	**		
	6	Nests $021 Flaring P'ls & Dippers	1.14	*	**		
				**	**		
		20 & 12½% -		**	**	**	**
	1	Doz. Champion Nutmeg Graters				1	75
1 Box .15	1	" Nests $4 Fancy Cov'd Pails		6	00		15
1 " .17	1	" $4 Burnished Tea Pots - -		6	75		17
				**	**		
		25 & 12½% -		*	**	*	**
	1	" $9 Pudding Pans - - - -		3	50		
	2	" $10 " " - - - - -	4.25	*	**		
	½	" $200 Pressed Kettles - -	5.50	*	**		
	1	" $220 " " - -		7			
				**	**		
		37½% -		*	**	**	**
	6	2 qt. En'ld Bel. Sauce Pans - -	.63	*	**		
	6	3 " " " " "	.73	*	**		
				*	**		
		40% -		*	**	*	**
		.75 .90					
	6	Enameled Kettles Ea. 4—5 qt. -		*	**		
		1.10 1.30					
	12	" " 6—8 qt. -		**	**		
				**	**		
		60% -		**	**	**	**
1 Crate	7	8—W. H. Tea Kettles - - -	.95	*	**		
		45% -		*	**	*	**
		4 Boxes 2.06, Carting .38 -				*	**
						**	**
		N. Y. C. & H. R. R. 975 lbs. @ 12¢					

[illegible] AGE.

[illegible] rage is [illegible] allowance [illegible] [illegible] ment of [illegible]

[illegible] by commission merchants [illegible] credit.

[illegible] is called [illegible] from [illegible]

[illegible] have possession of the [illegible] and purchases in their own name. [illegible] merchandise bought or sold are [illegible] of those who employ them, and [illegible] and contracts.

[illegible] applied to dealers in stocks, bonds, [illegible] only.

[illegible] quantity of merchandise sent by [illegible] sends it is called the Con- [illegible] Consignee.

[illegible] consignment is the balance due [illegible] have been deducted.

[illegible] gross proceeds. The [illegible]

[illegible] statement rendered [illegible] showing the sales [illegible] the same, and

[illegible]

involved in the transaction. In such cases the general principles of percentage are applied.

NOTES.—1. In buying and selling stocks, bonds, etc., the par value, and not the actual value, is taken as the base.

2. The commission for buying and selling some kinds of merchandise is usually computed at a certain price per unit of weight or measurement; as, grain per bushel, cotton per bale, etc.

EXAMPLES.

286. *1.* A commission merchant sold goods to the amount of $864; what was his commission at 2½ (¼ of 10) %?

2. A salesman sells goods at a commission of 2½%; what must be his sales, that he may have a yearly income of $5000?

3. What is the brokerage for selling 850 bales of cotton at the rate of $25 per 100 bales?

4. A lawyer collected a note of $2375; how much did he pay to the owner of the note, his commission being 5%?

5. My agent in Chicago purchases for me 600 barrels of flour at $3.75 per barrel; how much do I owe him, his commission for purchasing being 2%?

6. An officer collected $17850, and deposited $17493 in the Treasury, retaining the remainder as his commission. What was the rate per cent. of the commission?

7. Sent to a commission merchant in Toledo $2080.80 to invest in flour, his commission being 2% on the amount expended; how many barrels of flour would be purchased at $4.25 per barrel?

8. A commission merchant sells merchandise amounting to $3325; how much is paid to the consignor of the merchandise, the charges being, for transportation $117.50, for advertising $10, for storage $15, for commission 2½%?

9. My agent in Chicago buys for me 1187.76 centals wheat at $2.123 per cental. What is his commission at ½ per cent.?

10. A commission merchant purchased for me $9^{\underline{28}}$ bushels of clover seed at $8.[illegible]5 per bushel. How much should I send to him in settlement, if his commission for purchasing is 1 per cent.?

11. A broker buys 8375 pounds of leather at 26 cents per pound. What is his brokerage at ¾%, and what is the net amount received by the seller, the brokerage being paid by him?

12. A freight broker procures transportation for 375 tons of merchandise at $3.50 per ton; what is his brokerage at 5%?

[illegible] $2317, retaining [illegible] on the whole [illegible] what amount did he collect and what was his [illegible]

[illegible] commission of 5% thereon, [illegible] the note?

[illegible] at $120 each, and 12 at [illegible] and for transportation $92, and, after deducting [illegible] remitted $2208 to the manufacturer. What was [illegible] commission?

[illegible] instructs his agent in Cincinnati to buy pork [illegible] $000. The charges on the pork being $16, and [illegible] commission [illegible] how much must be remitted to settle

[illegible] the sale of 12372 pounds of [illegible] charges being $31, and a com- [illegible] for guaranteeing

[illegible] charged [illegible] for making the sale, [illegible] what was the

[illegible] at $3.75 [illegible] how much is due the con- [illegible]

[illegible] United States. [illegible] he pays out [illegible] commission [illegible] Mar. [illegible] in which [illegible] statement of his [illegible]

[illegible] gold, at

[illegible]

[illegible] $1970,

[illegible] But [illegible] the

[illegible] him [illegible] par-

[illegible] charging

25. A commission merchant sold 300 bales of cotton, averaging 462 *lb.* to the bale, at 15.7¢, his commission being 25¢ per bale, and the charges $161. He purchased for the consignor dry goods amounting to $2576.37, charging a commission of 1¼%. How much was still due the consignor?

26. A of Chicago, sends to B of New Orleans, 8000 *bu.* of wheat and 500 *bbls.* of flour with instructions to sell it and invest the proceeds in sugar. B pays freight and cartage $3420; sells the wheat at $1.60 per bushel and the flour at $5.25 per barrel; charges 2½% commission on the flour and 1¢ per bushel on the wheat: how many pounds of sugar are purchased at 8⅛ cents per pound, the commission for purchasing being 3%?

Copy the following accounts, and make the necessary extension, etc.

(27. Account Sales.)

NEW YORK, *Oct. 19, 1880.*

Sold for account of A. W. RANDOLPH & CO.,

By DAVID DOWS & CO.

1880.							
Sept.	12	100 Bbls. "Sunshine" - - - -	5.75	***			
"	18	125 " "Pride of the West" -	6.25	***	**		
"	30	150 " "Sunshine" - - - -	6.	***			
Oct.	14	75 " "Pride of the West" -	6.50	***	**		
"	18	50 " " " -	6.60	***		****	**
		Charges.					
Sept.	10	Transportation 500 Bbls. @ 27¢ - - -		***			
"	10	Cartage 400 " @ 5¢ - - -		**			
Oct.	19	Storage 400 " @ 3¢ - - -		**			
"	19	Insurance $\frac{1}{16}$% - - - - - - - - -		*	**		
"	19	Commission and Guarantee 5% - - -		***	**	***	**
		Net proceeds - - - - - -				****	**

(28. Account Purchase.)

TOLEDO, O., *Mar. 6, 1877.*

Purchased by A. L. BACKUS & SONS.

For account and risk of L. A. & W. B. SHAW.

	9	Bags "Montauk" - - - - - -	.21	*	**		
	2^{27}	Bu. Mammoth Clover Seed - -	9^{00}	**	**		
	9^{28}	" Clover Seed - - - - - - -	8^{55}	**	**		
	9^{21}	" Timothy Seed - - - - - -	1^{75}	**	**	***	**
		Charges.					
		Cartage - - - - - - - - - -			25		
		Commission 1% - - - - - - -		*	**	*	**
		Charge your % - - - - - -				***	**

PROFIT AND LOSS.

2[illegible]. Profit and Loss treats of the gains (profits) and losses which occur in business transactions.

The profit or loss is always estimated on the cost price, or the amount [illegible] discounts are reckoned on the market or asking price. (See Art. 2[illegible].)

2[illegible]. The difference between the cost of goods and the price at which they are sold is a **profit** or a **loss**,—profit if the selling price is the greater, loss if the cost is the greater.

EXAMPLES.

2[illegible]. [illegible] A man purchased a horse for $250, and sold it at a [illegible] (Gain = [illegible] × cost.)

[illegible] that cost $[illegible] at an advance of 12%: [illegible] Gain = 12% × cost, and selling [illegible] price = 112% × cost.

[illegible] $[illegible], and sold it at an advance of 25%: [illegible]

[illegible] is an aliquot part [illegible] equivalent [illegible] Thus [illegible]

[illegible] and sold at a loss of 20%. [illegible] = 80% × cost.

[illegible] price must it be sold

[illegible] what price must it

[illegible] what price must they be

[illegible] gain of 10%.

[illegible] an advance of

[illegible] $775, and

[illegible] an advance

12. A lot of dry goods was sold at an advance of 18%. If the gain was $436.50, what was the cost? (Gain = .18 × cost; hence, gain ÷ .18 = cost.)

13. A farm was bought for $7200, and sold at a gain of $900; what was the gain per cent.? (Gain = gain % × cost; hence, gain % = gain ÷ cost.)

14. A man paid for merchandise $875, and sold it for $1015; what per cent. did he gain?

15. A man paid for merchandise $1015, and sold it for $875; what per cent. did he lose?

16. Find the rate % of profit on goods bought for $324 and sold for $364.50.

17. A painting was sold for $2343, at a gain of 32%; what was the cost? [Selling price = 1.32 (100% + 32%) × cost; hence, cost = selling price ÷ 1.32.]

18. Find the cost of goods sold at an advance of 12½%, being a profit of $76.

19. How much was paid for a farm sold for $9878, at 12% below cost?

20. What is the profit on iron sold for $4520, at an advance of 13% on cost?

21. What is the selling price of tea which cost 32 cents per pound and is sold at a profit of 37½%?

22. Sold drugs for $168, at an advance of 75%; what was the profit?

23. A merchant sold for $2576 a lot of dry goods for which he paid $3360. What was the per cent. of loss?

24. A mixture is made of 1 gallon of wine at 50 cents a gallon, 3 at 90 cents, 4 at $1.20, and 12 at 40 cents. What per cent. would be gained by selling the mixture at $1.60 a gallon?

25. If, by selling tea at 47½ cents per pound, I lose 5%, at what price must I sell it to gain 15%?

26. If, by selling goods for $126, I lose 16%, what per cent. would I have lost or gained if I had sold them for $168?

27. A merchant's price is 25% above cost price. If he allows a customer a discount of 12% on his bill, what per cent. profit does he make?

28. If cloth, when sold at a loss of 25%, brings $5 per yard, what would be the gain or loss per cent. if sold at $6.40 per yard?

[illegible] Goods that cost $168 are sold at an advance of 25%; what is the selling price?

[illegible] What must be the asking price of goods costing $32, that I may deduct 20% from it, and still gain 25% on the cost?

[illegible] I sold a horse at a gain of 33⅓%, and with the proceeds purchased another horse, which I sold for $120 at a loss of 20%. What was the gain or loss?

[illegible] What must ribbon be sold per yard so as to gain 20%, if [illegible] yards cost $6.[illegible]?

[illegible] Books are purchased at a discount of 30% from the list price ($[illegible]). What is the gain per cent by selling at the list price?

[illegible] What per cent is gained by selling pens at 21 cents apiece, [illegible]

[illegible] are bought at a discount of [illegible] from the list price. What per cent is gained by selling at the list price?

[illegible] A merchant purchases goods at a discount of 25% from the list price. What per cent is gained by selling at the list price. [illegible] at a discount of 33⅓%? [illegible]

[illegible] per pair, by [illegible] He sells to a wholesale customer [illegible] What per cent [illegible]

[illegible] are purchased in [illegible] at [illegible] cents [illegible] What is the gain per cent [illegible] What was the total cost?

[illegible] the gain or loss per [illegible]

INTEREST.

DEFINITIONS.

290. Interest is a sum charged for the use of money, or its equivalent; or more strictly speaking, it is *the use of money,* or the service rendered in its use.

291. The **Principal** is the sum for the use of which interest is charged.

292. The **Rate** is the per cent., or number of hundredths, of the principal, charged for its use for a certain time, usually for one year (per annum). When no time is mentioned with the rate in the contract, a year is understood.

293. The **Amount** is the sum of the principal and interest.

If $1000 is loaned for one year at 6% per annum, $60 would be the interest, $1000 the principal, and $1060 the amount.

294. Simple Interest is interest on the principal only for the full time.

295. Compound Interest is interest not only on the principal, but on the interest also after it becomes due.

If $1000 is loaned Jan. 1, 1881, for 2 years, the amount due Jan. 1, 1883, at 6% simple interest, would be $1000 (Principal) plus $120 (Simple Interest), or $1120. At compound interest the amount due Jan. 1, 1882, would be $1060 ($1000 + $60); the amount due Jan. 1, 1883, would be $1060 plus $63.60 (6% of $1060), or $1123.60. The simple interest for 2 years would be $120; the compound interest for the same time, $123.60. When the word interest is used alone, simple interest is understood.

296. Legal Interest is the interest according to the rate per cent. fixed by law for cases in which the rate per cent. is not specified. By special agreement between parties in certain States, interest may be received at a rate higher than the legal rate. In most of the States, this rate is limited. See Art. **298**.

297. Usury is the taking of a higher rate of interest than that allowed by law. A person taking usury is liable to certain penalties differing in the several States.

298. The following table, prepared from information received from the Secretaries of the several States and Territories, April 1, 1880, shows in the first column the legal rate of interest when no rate is specified in the contract, and in the second column the maximum rate allowed by law.

State or Territory.	Rate.		State or Territory.	Rate.	
Alabama	8%	8%	Mississippi	6%	10%
*Alaska Ter.	....	....	Missouri	6%	10%
Arkansas	6%	10%	Montana (Ter.)	10%	Any
†Arizona (Ter.	10%	Any	Nebraska	7%	10%
‡California	10%	Any	Nevada	10%	Any
§Colorado	10%	Any	New Hampshire	6%	6%
Connecticut	6%	6%	New Jersey	6%	6%
Dakota Ter.	7%	12%	New Mexico Ter.	....	Any
Delaware	6%	6%	‖New York	6%	6%
Florida	8%	Any	North Carolina	6%	8%
Georgia	7%	8%	Ohio	6%	8%
Idaho Ter.	10%	18%	Oregon	10%	12%
Illinois	6%	8%	Pennsylvania	6%	6%
Indian Ter.	6%	Any	Rhode Island	6%	Any
Indiana	6%	8%	South Carolina	7%	7%
Iowa	6%	10%	Tennessee	6%	6%
Kansas	7%	12%	Texas	8%	12%
Kentucky	6%	6%	Utah Ter.	....	Any
Louisiana	5%	8%	Vermont	6%	6%
Maine	6%	Any	Virginia	6%	6%
Maryland	6%	6%	Washington Ter.	10%	Any
Massachusetts	6%	Any	West Virginia	6%	8%
Michigan	7%	10%	Wisconsin	7%	10%
Minnesota	7%	10%	Wyoming Ter.	12%	Any

---

* No legislation.

† "Pawnbrokers are allowed to charge 3% per month."

‡ On judgments recovered in the courts 7%, but must not be compounded in any manner.

§ Most banks pay 5% on time deposits and charge from 1 to 2% per month on loans.

‖ "Advances payable on demand (call loans), of not less than $5000, on negotiable collaterals, are not subject to the interest laws, but may be made for any compensation agreed upon in writing."

299. Interest for Parts of a Year.—Although many of the States have rigid laws in regard to the rate per cent. to be charged per annum, few of them specify on what basis interest should be reckoned for a period of time less than a year. The following methods are in common use:

1. Finding the time in months and days (Compound Subtraction, Art. **210**, 1), and regarding the months as twelfths of a year, and the days as thirtieths of a month or 360ths of a year. This method, although implied by the general interest laws* of the State of New York, is not uniform, since it allows the same interest for February with its 28 days as for March with its 31 days. Its results are sometimes greater and sometimes less than those of accurate interest.

2. Finding the exact time in days (**210**, 2) and regarding the days as 360ths of a year. Since a day is $\frac{1}{365}$ of a year, this method produces too great a result. It is however used by merchants, brokers, and bankers generally, and by many banks† in discounting notes. 6% by this method is equivalent to $6\frac{1}{12}$% accurate interest.

3. **Accurate Interest.**—Finding the exact time in days (**210**, 2) and regarding the days as 365ths of a year. This method is used by the United States government, and by some merchants and banks; but, on account of its inconvenience when interest tables are not used, it is not generally adopted.

NOTES.—1. By the first method, the time from July 10 to Sept. 10, would be 2 months, and the interest would be $\frac{2}{12}$ or $\frac{1}{6}$ of the interest for one year. On $10000 at 6% for 2 months, the interest would be $100 ($\frac{1}{6}$ of .06 of $10000).

2. By the second method, the interval between the same dates would be 62 days, and the interest would be $\frac{62}{360}$ of the interest for one year. On $10000 at 6% for $\frac{62}{360}$ of a year, the interest would be $103.33 ($\frac{62}{360}$ of .06 of $10000).

---

[*] "For the purpose of calculating interest, a month shall be considered the twelfth part of a year, and as consisting of thirty days; and interest for any number of days less than a month shall be estimated by the proportion which such number of days shall bear to thirty." (R. S., page 1165.)

[†] According to the banking laws of the State of New York, banks are authorized in discounting notes to charge interest in advance for the exact number of days which the note has to run (Ch. XVIII, Title 2, § 260).

This law appears to conflict with the law quoted above which implies that the time shall be found in months and days. It does not state whether the days shall be considered 360ths or 365ths of a year.

3. By the third method, the interval between the same dates would be 92 days as in the second method, and the interest would be $\frac{92}{365}$ of the interest for one year. On $10000 at 6% for $\frac{92}{365}$ of a year, the interest would be $[illegible] ($\frac{92}{365}$ of .06 of $10000).

4. The difference between ordinary interest and accurate interest for the same number of days is $\frac{1}{73}$ of the former, or $\frac{1}{72}$ of the latter (317). Thus in the above example, the difference between the results, $1.41 ($103.33–101.92), is $\frac{1}{73}$ of $103.33, or $\frac{1}{72}$ of $101.92.

5. Unless the words "Accurate Interest" are used, all computations in this book are made on the basis of 360 days to the year.

300. Interest is an application of percentage, the element of time being introduced. Therefore the four elements or parts in interest are the Principal (the Base), the Rate, the Interest (the Percentage), and the Time; any three of which being given, the other may be found.

301. To find the interest for any number of years and months.

Ex. What is the interest and amount of $324 for 2 yr. 3 mo., at 8%?

OPERATION.

$324	principal	Or	$324
.08			.18
$25.92	interest for 1 yr.		2592
2¼			324
648			58.32
5184			324
$58.32	interest for 2¼ yr.		$382.32
324	principal		
$382.32	amount for 2¼ yr.		

[illegible] interest of $324 for 1 year is .08 of $324, the [illegible] $324 for 1 year at 8% is $25.92, for [illegible] $58.32. The amount is $324 plus [illegible]

[illegible] the principal [illegible] that product [illegible] fraction of a [illegible] interest.

NOTES.—1. When the rate per month is given, apply the same rule, *i. e.*, multiply the principal by the rate per month expressed decimally, and that product by the number of months.

2. Instead of multiplying by the rate and time separately, the process may be shortened by multiplying the principal by the product of the rate and time. In the above example, multiply $324 by .18 (2¼ × .08).

EXAMPLES.

303. Find the interest of

1. $875 for 2 *yr.* at 7%.
2. $642.50 for 3 *yr.* at 6%.
3. $1010.10 for 6 *yr.* 6 *mo.*, at 8%.
4. $3010.75 for 3 *yr.* 4 *mo.*, at 7%.
5. $3745.80 for 4 *yr.* 1 *mo.*, at 6%.
6. $816.40 for 5 *yr.* 3 *mo.*, at 5%.
7. $1275 for 7 *yr.* at 6%.
8. $2789.40 for 3 *yr.* 2 *mo.*, at 4½%.
9. $456.75 for 4 *yr.* 8 *mo.*, at 5%.
10. $10180 for 3 *yr.* 4 *mo.*, at 10%.

NOTE.—In the following examples find the time by Compound Subtraction.

11. What is the interest of $6488 from May 3, 1879, to Sept. 3, 1881, at 7%?

12. What is the amount of $396.60 from Aug. 16, 1880, to Dec. 16, 1882, at 8%?

13. Find the interest of $864.30 from Jan. 1, 1881, to June 1, 1883, at 4%.

14. Compute the interest of $250.75 from Nov. 20, 1882, to July 20, 1884, at 4½%.

15. Loaned on interest, New York, Dec. 16, 1880, $1739.75 (no rate specified); what amount should I receive, June 16, 1881?

16. In settling with a merchant Oct. 3, 1882, I gave my note for $254.60, at 7%; what must be paid Aug. 3, 1883?

304. To find the ordinary interest (360 days to the year) for any rate and time.

305. 60-day Method at 6%.—6% for 12 months or 1 year, is equivalent to 1% for 2 months (60 days), or ⅙ of one year. 1% of any amount is readily ascertained by placing the point two places to the left. Hence the interest of any sum at 6% per annum for 2 months, or 60 days, may be found by placing the point two places to the left.

NOTE.—It will be found advantageous to use a perpendicular line as a separatrix in solving examples by this method. All necessity for pointing off will then be dispensed with, and confusion prevented.

Ex. What is the interest of $1236 for 80 *da.*, at 6%?

OPERATION.

$12	36	= int. for 60 *da.*
4	12	= " " 20 *da.*
$16	48	= " " 80 *da.*

ANALYSIS.—The interest of $1236 at 6% for 60 *da.* is found to be $12.36, by the process already explained. If the interest for 60 *da.* is $12.36, for 20 *da.* (⅓ of 60), it will be ⅓ of $12.36, or $4.12. Hence for 80 *da.*, it will be $12.36 plus $4.12, or $16.48.

Ex. What is the interest of $864 for 1 *yr.* 10 *mo.* 15 *da.*, at 6%?

OPERATION.

$8	64	= int. for 60 *da.*
	11	
95	04	= int. for 22 *mo.*
2	16	= " " 15 *da.*
$97	20	= required int.

ANALYSIS.—The interest of $864 at 6% for 2 *mo.* is $8.64. For 1 *yr.* 10 *mo.* (22 *mo.*), it will be 11 times $8.64, or $95.04. If the interest for 60 *da.* is $8.64, for 15 *da.* (¼ of 60), it will be ¼ of $8.64, or $2.16. Hence the interest for the given time will be $95.04 plus $2.16, or $97.20.

Ex. What is the interest of $1732.80 for 2 *yr.* 9 *mo.* 23 *da.*, at 7%?

OPERATION.

$17	32.80	= int. for 2 *mo.* or 60 *da.*
	16½	
8	6640	
103	9680	
173	280	
5	776	= int. for 20 *da.*
	866	= " " 3 "
6) 292	554	= " " given time at 6%.
48	759	= " " " " 1%.
$341	313	= " " " " 7%.

ANALYSIS.—The interest for 2 *mo.*, forming the basis, is $17.328. Multiply this by 16½, to find the interest for 33 *mo.* (2 *yr.* 9 *mo.*). As 23 is not an aliquot part of 60, take 20, which is ⅓ of 60, and 3, which is $\frac{1}{20}$ of 60. Divide the basis, which is the interest for 60 *da.*, by 3, to find the interest for 20 *da.* ($5.776); and the same sum by 20, to find the interest for 3 *da.* ($0.866). By adding these various sums, we have the interest for the given time at 6% ($292.554). To this result add ⅙ of itself, which is the interest for the given time at 1%, and the required interest is obtained ($341.31).

306. Aliquot Parts of 60.—$1 = \frac{1}{60}$; $2 = \frac{1}{30}$; $3 = \frac{1}{20}$; $4 = \frac{1}{15}$; $5 = \frac{1}{12}$; $6 = \frac{1}{10}$; $10 = \frac{1}{6}$; $12 = \frac{1}{5}$; $15 = \frac{1}{4}$; $20 = \frac{1}{3}$; $30 = \frac{1}{2}$.

NOTES.—1. To divide by 10, place the figures of the basis one place to the right.

2. To divide by 20, 30, or 60, divide by the first figure and write the quotient figures one place to the right.

307. If the number of days given is other than any of the above, which are aliquot parts of 60, it will need to be so separated that the component parts will be aliquot parts of 60.

Numbers not aliquot parts of 60, with best divisions: $7 = 6+1$; $8 = 6+2$; $9 = 6+3$; $11 = 6+5$, or $10+1$; $13 = 10+3$; $14 = 12+2$; $16 = 10+6$; $17 = 12+5$, or $15+2$; $18 = 12+6$. (The interest for 18 days may be found by multiplying the basis by 3, and placing the figures of the product one place to the right); $19 = 15+4$, or $10+6+3$; $21 = 15+6$; $22 = 20+2$ ($2 = \frac{1}{10}$ of 20); $23 = 20+3$; $24 = 12+12$ (Or multiply by 4 and place the figures of the product one place to the right); $25 = 20+5$ ($5 = \frac{1}{4}$ of 20); $26 = 20+6$; $27 = 12+15$; $28 = 12+12+4$ ($4 = \frac{1}{3}$ of 12), or $20+6+2$; $29 = 12+12+5$, or $20+6+3$.

308. RULE.—*Draw a perpendicular line two places to the left of the decimal point; the result will be the interest at 6% for 2 months, or 60 days, the dollars being on the left, and the cents on the right of this line. Multiply this result by one-half the total number of months. To this product, add that proportion of the interest for 60 days, which the given number of days is of 60.*

309. The interest for any other rate may be found from the interest at 6% as follows: At 1%, divide by 6; at $1\frac{1}{2}\%$, divide by 4; at 2%, divide by 3; at 3%, divide by 2; at 4%, subtract $\frac{1}{3}$; at $4\frac{1}{2}\%$, subtract $\frac{1}{4}$; at 5%, subtract $\frac{1}{6}$; at 7%, add $\frac{1}{6}$; at 8%, add $\frac{1}{3}$; at 9%, add $\frac{1}{2}$; at 10%, divide by 6, and multiply by 10 by placing the point to the right one place; at 12%, multiply by 2. At any per cent., divide by 6 and multiply by the rate.

310. 6% Method.—At 6%, the interest for one year is .06 of the principal. For one month, $\frac{1}{12}$ of a year, it will be $\frac{1}{12}$ of .06, or $.00\frac{1}{2}$ (.005). For one day, $\frac{1}{30}$ of a month, it will be $\frac{1}{30}$ of .005, or $.000\frac{1}{6}$.

[illegible] What is the interest of $864, at 6%, for 2 yr. 7 mo. 20 da.?

[illegible]

ANALYSIS.—If the interest for 1 yr. is .06 of the principal, for 2 yr. it will be twice .06, or .12. If the interest for 1 mo. is .00½ of the principal, for 7 mo. it will be 7 times .00½, or .035. If the interest for 1 day is .000⅙ of the principal, for 20 da. it will be 20 times .000⅙, or .003⅓. Hence the interest for the given time will be .158⅓ of the principal, $864, or $136.80.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

313. RULE.—*Multiply the principal by the number of days, divide the product by 6, and place the point 3 places to the left. The result will be the interest at 6%.*

NOTES.—1. The interest at any other per cent. may be found as in Art. **309**. To find the interest at 3%, divide by 12 instead of 6; at 4%, by 9; at 9%, by 4.

2. If the principal is a multiple of the divisor (6 in the above example), time can be saved by performing the division first. Thus, to find the interest of $1200 for 113 days, divide 1200 by 6, and multiply the quotient 200 by 113, producing 22600. By pointing off three places, the required interest is $22.60.

EXAMPLES.

314. What is the interest of

1. $375.60 for 8 *mo.* 20 *da.*, at 6%?

2. $1727 for 7 *mo.* 15 *da.*, at 6%?

3. $449.38 for 1 *yr.* 4 *mo.* 12 *da.*, at 6%? At 7%?

4. $285 for 1 *yr.* 5 *mo.* 10 *da.*, at 6%? At 5%?

5. $432.65 for 2 *yr.* 2 *mo.* 6 *da.*, at 6%? At 8%?

6. $1235 for 2 *yr.* 5 *mo.* 5 *da.*, at 6%? At 4%?

7. $445.25 for 5 *mo.* 4 *da.*, at 6%? At 9%?

8. $1000 for 93 days, at 6%? At 7%?

9. $2416.60 for 72 days, at 6%? At 7%?

10. $3210 for 62 days, at 6%? At 8%?

11. $735 for 75 days, at 6%? At 5%?

12. $812.45 for 121 days, at 6%? At 4%?

13. $2440.50 for 97 days, at 6%? At 7%?

14. $3125 for 38 days, at 6%? At 7%?

15. $247.50 for 69 days, at 6%? At 5%?

16. $512.45 for 5 *mo.* 11 *da.*, at 6%? At 7%?

17. $1478 for 1 *yr.* 2 *mo.* 13 *da.*, at 6%? At 8%?

18. $2810.60 for 9 *mo.* 24 *da.*, at 6%? At 5%?

19. $944.50 for 1 *yr.* 10 *mo.* 22 *da.*, at 6%? At 4½%?

20. $575 for 2 *yr.* 8 *mo.* 16 *da.*, at 6%? At 9%?

21. $1112 for 3 *mo.* 14 *da.*, at 6%? At 4½%?

22. $5285 for 1 *yr.* 6 *mo.* 21 *da.*, at 6%? At 3%?

23. $7218 for 11 *mo.* 18 *da.*, at 6%? At 12%?

24. $416.75 for 8 *mo.* 17 *da.*, at 6%? At 7%?

25. $1235 for 2 *yr.* 1 *mo.* 19 *da.*, at 6%? At 8%?

26. $575.60 for 1 *yr.* 4 *mo.* 23 *da.*, at 6%? At 5%?

27. $2214 for 4 *mo.* 25 *da.*, at 6%? At 4%?

[illegible] $4415 for 5 *mo.* 29 *da.*, at 6%? At 9%?

[illegible] $4419 for 4 *mo.* 28 *da.*, at 6%? At 4½%?

[illegible] $484.30 for 3 *mo.* 28 *da.*, at 6%? At 3%?

[illegible] $1[illegible] for 1 *yr.* 11 *mo.* 27 *da.*, at 6%? At 12%?

[illegible] $[illegible] for 2 *yr.* 8 *mo.* 24 *da.*, at 6%? At 5½%?

Note. [illegible] the time in the following examples both in months and days, [illegible] days 210.

[illegible] $[illegible] from May [illegible] to Dec. 4, at [illegible]? At 4½%?

[illegible] $[illegible] from Jan. 15 [illegible] Nov. [illegible]? At [illegible]?

[illegible] $[illegible] from June [illegible], 188[illegible] to [illegible], 188[illegible], at [illegible]?

[illegible]

[illegible] $[illegible] from [illegible] 188[illegible] to Nov. [illegible], 1885, at [illegible]?

[illegible]

[illegible] $[illegible] from Aug. [illegible] 188[illegible] to Jan. [illegible], 1884, at [illegible]?

[illegible]

[illegible] $[illegible] from May [illegible], 188[illegible] to Feb. [illegible], 1884, at [illegible]?

[illegible]

[illegible] the interest of $[illegible] for [illegible] days, at [illegible]. At [illegible].

[illegible]

[illegible] interest [illegible] for [illegible] days at [illegible]. At 4%.

[illegible] interest [illegible] for [illegible] days at [illegible]. At 8%.

[illegible] interest [illegible] from Jan. [illegible] to Dec. [illegible], at 8%.

[illegible]

[illegible] interest [illegible] from May 1 to [illegible], at 8%.

[illegible]

[illegible]

[illegible] $1,000 [illegible]

[illegible]

[illegible] What was the [illegible]

[illegible]

ACCURATE INTEREST.

315. To find the accurate interest (365 days to the year) for any rate and time. See Art. **299**.

Ex. What is the accurate interest of \$865, at 4%, from June 21 to Dec. 13?

OPERATION.

```
      $865   Principal.
       .04
      -----
     34.60   Interest for 1 yr.
      175
    -------
365 ) 6055.00 ( 16.59
```

ANALYSIS.—From June 21 to Dec. 13, there are 175 days. The interest of \$865 for 1 *yr.*, at 4%, is \$34.60. For 175 days, $\frac{175}{365}$ of 1 *yr.*, it is $\frac{175}{365}$ of \$34.60 $\left(\frac{175 \times 34.60}{365}\right)$, or \$16.59.

316. RULE.—*Multiply the principal by the rate per cent. expressed decimally. The result will be the interest for 1 year.*

Multiply the interest for 1 year by the number of days, and divide the product by 365.

NOTES.—1. When the number of days is a multiple of 5, multiply by $\frac{1}{5}$ the number of days, and divide the product by 73. In the above example, \$865 × .04 × 35 ÷ 73 = \$16.59.

2. To find the interest at any per cent., multiply by twice the rate as an integer, by the number of days, divide the product by 73, and point off 3 places. In the above example, \$865 × 8 × 175 ÷ 73000 = \$16.59.

3. To find the interest at 5%, multiply the principal by the number of days, divide the product by 73, and point off 2 places. From this result to find the interest at 6%, add $\frac{1}{5}$; 4½%, subtract $\frac{1}{10}$; 4%, subtract $\frac{1}{5}$.

317. Accurate Interest from Ordinary Interest.—The difference between ordinary interest and accurate interest for 1 day equals the difference between $\frac{1}{360}$ and $\frac{1}{365}$ of a year's interest.

$$\frac{1}{360} - \frac{1}{365} = \frac{365 - 360}{365 \times 360} = \frac{5}{365 \times 360} = \frac{5}{365} \text{ of } \frac{1}{360} = \frac{1}{73} \text{ of } \frac{1}{360}. \quad \frac{5}{365 \times 360} = \frac{5}{360} \text{ of } \frac{1}{365} = \frac{1}{72} \text{ of } \frac{1}{365}.$$

The difference between the two methods is $\frac{1}{73}$ of ordinary interest, or $\frac{1}{72}$ of accurate interest (**299**, Note 4). Therefore, from ordinary interest to find accurate interest subtract $\frac{1}{73}$.

In reckoning accurate interest, on account of the many short methods of ordinary interest, many accountants prefer to calculate ordinary interest first, and then make the necessary deduction.

Since [illegible] is about 1⅓%, the following approximate method may be used in reducing ordinary interest to accurate interest: *From the ordinary interest [illegible] and ⅓% of itself.*

Ex. Reduce $32.70 ordinary interest to accurate interest.

OPERATION.

$32.70
.327 1%
$32.373
.109 ⅓%
$32.264

NOTE.—The exact result should be $32.252. The results by this method are too great by 1 cent for each $27 interest; $.036 for each $100 interest; $.36 for each $1000 interest. Where greater accuracy is required, the necessary correction can be made.

EXAMPLES.

348. What is the accurate interest of

[illegible], at 6%, for 23 days? [illegible] at 3½%, for 140 days?
[illegible], at 5%, for 141 days? [illegible] $438, at 6%, for 210 days?
[illegible], at 6%, for 60 days? [illegible] $350, at 4%, for 150 days?
[illegible], at 7%, for 63 days? [illegible] $500, at 4½%, for 100 days?
[illegible], at 5½%, for 90 days?
[illegible], at 7%, from June 4 to Dec. 28?
[illegible], from July 24 to Sept. 13?
[illegible], from June 30 to Dec. 31?
[illegible], from May [illegible], 1878, to Jan. 30, 1879?
[illegible], from Jan. [illegible], 1879, to Jan. 21, 1880?
[illegible] exact interest on three U. S. bonds of $5000 [illegible] to Aug. 31.
[illegible] interest on three U. S. bonds of $1000 each, at [illegible] Nov. [illegible]
[illegible] interest on a $5000 U. S. bond, at 4%, from [illegible]
[illegible] bond of $1000, bearing [illegible]
[illegible] U. S. bond, at 4%, from [illegible]
[illegible] U. S. bond from Nov. 1, [illegible]
[illegible] ordinary and accurate [illegible]

PROBLEMS IN INTEREST.

319. To find the rate, the principal, interest or amount, and time, being given.

Ex. At what rate will $720 in 1 *yr.* 4 *mo.* 10 *da.,* produce $44.10 interest?

OPERATION.

$7	20
	8
57	60
1	20
6) 58	80
$9	80) $44.10 (4½ *Ans.*

ANALYSIS. — The interest on a given principal for a given time is in proportion to the rate per cent. At one per cent., $720 will in 1 *yr.* 4 *mo.* 10 *da.,* produce $9.80 interest. To produce $44.10 interest, the required rate must be as many times 1%, as $9.80 are contained times in $44.10, or 4½ times. Hence the answer is 4½%.

320. RULE.—*Divide the given interest by the interest of the given principal, for the given time, at 1%.*

NOTE.—When the amount is given, find the interest by subtracting the principal from the amount.

EXAMPLES.

321. At what rate will

1. $864 in 8 *mo.* 10 *da.* produce $42 interest?
2. $1000 in 9 *mo.* 9 *da.* produce $54.25 interest?
3. $852 in 1 *yr.* 7 *mo.* 16 *da.* amount to $935.21?
4. $1926 in 2 *yr.* 8 *mo.* 24 *da.* produce $263.22 interest?
5. $375.60 in 1 *yr.* 10 *mo.* 22 *da.* amount to $425.41?
6. $1872 in 7 *mo.* 17 *da.* produce $41.31 interest?
7. $435.60 in 1 *yr.* 2 *mo.* 18 *da.* amount to $478?
8. $1338.72 in 6 *mo.* 27 *da.* produce $34.64 interest?
9. $1728 in 8 *mo.* 21 *da.* amount to $1778.11?
10. $3456 in 5 *mo.* 8 *da.* produce $91.01 interest?
11. $5280 in 11 *mo.* 11 *da.* amount to $5720.12?
12. $1234 in 8 *mo.* 22 *da.* produce $80.83 interest?
13. $6975 in 3 *mo.* 28 *da.* amount to $7215.06?
14. $525 in 1 *yr.* 11 *mo.* 18 *da.* produce $309.75 interest?
15. $500 in 3 *yr.* 11 *mo.* 12 *da.* amount to $658?
16. $4680 in 2 *yr.* 6 *mo.* 11 *da.* produce $710.58 interest?
17. $614.45 in 162 days amount to $633.805?

322. To find the time, the principal, interest or amount, and rate, being given.

Ex. In what time will $426, at 6%, produce $59.427 interest?

OPERATIONS.

```
$426                              Or   $426
  .06                                    .06
-----                                 -------
$25.56 ) $59.427 ( yr. 2.325          $25.56 ) $59.427 ( 2 yr.
           51 12         12                     51 12
           -----       -----                    -----
           8 307  mo. 3.900                      8.307
           7 668           30                       12
           -----       ------                   -------
            6390  da. 27.000          $25.56 ) 99.684 ( 3 mo.
            5112                                76.68
            -----                               ------
            12780                               23.004
            12780                                   30
            -----                               -------
                0                     $25.56 ) 690.120 ( 27 da.
```

ANALYSIS.—The interest on a given principal at a given rate %, is in proportion to the time. In one year, $426, at 6%, will produce $25.56 interest. To produce $59.427 interest, it will require as many years as $25.56 is contained times in $59.427, or 2.325 *yr.* 2.325 *yr.* equal 2 *yr.* 3 *mo.* 27 *da.* (**201**).

323. RULE.—*Divide the given interest by the interest of the given principal, at the given rate, for 1 year.*

The integral part of the quotient will be years. Reduce the decimal, if any, to months and days (**201**).

EXAMPLES.

324. In what time will

1. $3000, at 7%, produce $108.50 interest?
2. $1728, at 6%, amount to $1872 ?
3. $3932, at 7%, produce $597.88 interest?
4. $735, at 5%, amount to $742.66 ?
5. $1222.25, at 6%, produce $39.52 interest?
6. $375.60, at 7%, amount to $425.41 ?
7. $1461.75, at 6%, produce $420.25 interest?
8. $1200, at 3¾%, amount to $1413 ?
9. $4500, at 5%, produce $181.25 interest ?
10. $276.50, at 10%, amount to $303.46 ?

11. **$1020, at 6%, produce $89.25 interest?**
12. **$6495, at 7%, amount to $7161.81 ?**
13. **$100, at 6%, produce $100 interest ?**
14. **$125, at 7%, amount to $375 ?**

325. To find the principal, the interest, time, and rate, eing given.

Ex. What principal will produce $152.64 interest, in 1 *yr.* *mo.* 20 *da.*, at 6%?

OPERATION.

```
.088⅓ ) $152.64 ( 1728.
    3         3
.265  )  457.920
         265
         1929
         1855
          742
          530
         2120
         2120
            0
```

ANALYSIS.—The interest on any principal is as many times greater than the interest of $1, as that principal is greater than $1. One dollar, in 1 *yr.* 5 *mo.* 20 *da.*, at 6% (**310**), will produce $.088⅓ interest. To produce $152.64, the principal must be as many times $1 as $.088⅓ is contained times in $152.64, or $1728.

326. RULE.—*Divide the given interest by the interest of $1 for the given time, at the given rate.*

EXAMPLES.

327. What principal will produce
1. $1235 interest, in 1 *yr.* 8 *mo.* 12 *da.*, at 6% ?
2. $49.81, in 9 *mo.* 24 *da.*, at 7% ?
3. $186.75, in 1 *yr.* 4 *mo.* 20 *da.*, at 6%?
4. $244.44, in 7 *mo.* 18 *da.*, at 5% ?
5. $375.60, in 2 *yr.* 4 *mo.* 6 *da.*, at 8% ?
6. $54.25, in 3 *mo.* 3 *da.*, at 7% ?
7. $387.40, in 2 *yr.* 8 *mo.*, at 4½% ?
8. $456, in 93 *da.*, at 6% ?
9. $375, in 63 *da.*, at 7% ?
10. $1000, in 1 *yr.* 18 *da.*, at 3% ?
11. $538.80, in 10 *mo.* 24 *da.*, at 5%.
12. $416.75, in 8 *mo.* 21 *da.*, at 4%?
13. $645.39, in 4 *yr.* 8 *mo.* 10 *da.*, at 4% ?

To find the principal, the amount, time, and rate, being given.

Ex. What principal will amount to $1880.64, in 1 yr. 5 mo. 20 da., at 6%?

1.088⅓)1880.64(1728
3
3.265)5641.920
3265
23769
22855
9142
6530
26120
26120
0

ANALYSIS.—The amounts of different principals for the same time and rate %, are to each other as the principals. One dollar, in 1 yr. 5 mo. 20 da., at 6%, will amount to $1.088⅓. To amount to $1880.64, the principal must be as many times $1 as $1.088⅓ are contained times in $1880.64, or $1728.

329. RULE.—*Divide the given amount by the amount of $1 for the given time, at the given rate.*

EXAMPLES.

330. What principal will amount to

1. $1272.354, in 6 *mo.* 6 *da.*, at 6%?
2. $[illegible].72, in 3 *mo.* 12 *da.*, at 7%?
3. $[illegible].64, in 1 *yr.* 4 *mo.* 18 *da.*, at 5%?
4. $442.91, in 2 *yr.* 2 *mo.* 24 *da.*, at 8%?
5. $14901.31, in 3 *yr.* 3 *mo.* 3 *da.*, at 6%?
6. $1903.38, in 9 *mo.* 17 *da.*, at 6%?
7. $1010.65, in 5 *yr.* 8 *mo.* 6 *da.*, at 7%?
8. $977.75, in 1 *yr.* 10 *mo.* 10 *da.*, at 6%?
9. $1716.75 in 3 *yr.* 4 *mo.* 21 *da.*, at 4%?
10. $2040.60, in 2 *yr.* 8 *mo.* 12 *da.*, at 8%?
11. $1312.23, in 1 *yr.* 2 *mo.* 11 *da.*, at 12%?
12. $6020.49, in 4 *yr.* 7 *mo.* 6 *da.*, at 5%?
13. $1763.03, in 1 *yr.* 2 *mo.* 21 *da.*, at 6%?
14. $2161.20, in 3 *yr.* 5 *mo.* 23 *da.*, at 6%?
15. $6375.31, in 1 *yr.* 6 *mo.* 15 *da.*, at 4%?
16. $3530.67, in 3 *yr.* 7 *mo.* 10 *da.*, at 9%?
17. $1221.50, in 3 *yr.* 10 *mo.* 27 *da.*, at 4½%?

PRESENT WORTH AND TRUE DISCOUNT.

331. The **Present Worth** of a debt due at some future time is its value now. Theoretically, it is such a sum that, if placed at interest to-day for the given time, would amount to the face of the debt.

332. The **True Discount** is the difference between the face of the debt and the present worth.

This subject is an application of the principle illustrated in Art. **328**, the face of the debt being the amount, the present worth the principal, and the true discount the interest.

In actual business, true discount is little used, banks and merchants generally using bank discount (**355**). True discount is the interest on the present worth for the given time, while bank discount is interest on the face of the debt. The difference is therefore equivalent to the interest on the true discount. For discount on bills, etc., when time does not enter in as an element, see Art. **274**.

Ex. Mr. B owes me $212, payable one year from to-day without interest; what is the present worth of the debt, the current rate of interest being 6% ?

ANALYSIS.—Since $1 in one year, at 6%, amounts to $1.06, it would require as many dollars to amount to $212, as $1.06 are contained times in $212, or $200. The true discount is $212 − $200, or $12.

333. RULE.—*I. To find the present worth, divide the face of the debt by the amount of $1 for the given time, at the given rate.*

II. To find the true discount, subtract the present worth from the face of the debt.

EXAMPLES.

334. The current rate of interest being 6%, what is the present worth and true discount of

1. $1000, due 2 years hence? *3.* $600, due in 1 *yr.* 7 *mo.*?
2. $500, due in 2 *yr.* 4 *mo.*? *4.* $800, due in 9 *mo.* 24 *da.*?
5. $325, due in 2 *yr.* 5 *mo.* 12 *da.*?
6. $175, due in 1 *yr.* 4 *mo.* 16 *da.*?
7. $800, due in 5 *yr.* 8 *mo.* 22 *da.*?
8. $900, due in 6 *yr.* 8 *mo.* 14 *da.*?

9. Mr. C. desiring to pay a bill of $1728 4 months before it was due, was allowed a discount equivalent to the interest on the face of the bill for the unexpired time at 6% per annum (bank discount). How much greater was this discount than the true discount?

10. Goods to the amount of $3750 are sold on a credit of 4 months. For how much cash could the merchant afford to sell the same goods, money being worth 10% per annum?

11. If $[illegible] will be due me May 28, and $[illegible] May 16, what discount should I make on the two claims Apr. 1, money being worth [illegible]?

REVIEW EXAMPLES.

222. 1. What is the interest of $[illegible] for 1 *yr.* 10 *mo.* [illegible] *da.*, at [illegible]%?

2. What is the amount of $[illegible] for 7 *mo.* [illegible] *da.*, at 7%?

3. At what rate will $1234, in 2 *yr.* 2 *mo.* 26 *da.*, produce $[illegible] interest?

4. In what time will $585, at 6%, produce $67.08 interest?

5. What principal will, in 1 *yr.* 5 *mo.* 14 *da.*, at 6%, produce $[illegible] interest?

6. The semi-annual interest on a mortgage at 7% is $350. What is the face of the mortgage?

7. Mr. R. invests $[illegible] in a business that pays him $594 per month. What annual rate of interest does he receive?

8. Which is the better investment, and what per cent., one of $[illegible], yielding $[illegible] semi-annually, or one of $15000, producing $[illegible] annually?

9. [illegible] a speculator bought 1600 bushels of wheat, at [illegible]. He afterward sold the whole for $[illegible] cash. [illegible] per annum on the amount invested. [illegible]

[illegible] $[illegible], and [illegible]. What per cent. is [illegible]

[illegible]

13. A gentleman loaned $15000, at 6%. Jan. 1, 1880, interest and principal together equalled $20000. When was the money loaned?

14. Find the interest on $3000, from Mar. 16 to Dec. 4, at 6%, by the following methods (**299**): 1, ordinary interest and compound subtraction; 2, ordinary interest and exact number of days; 3, accurate interest.

15. Oct. 1, 1880, the loans and discounts of the National Banks of the United States amounted to $1,041,000,000. At 6%, what would be the difference between the ordinary (360 days) and accurate (365 days) interest of this amount for 1 day?

16. How much is paid for the use of $1000 from Dec. 2 to Dec. 17, accurate interest at 6%, and a commission of $\frac{1}{32}$% per day being charged?

17. 6% per annum accurate interest and a bonus of $\frac{1}{32}$% per day is equivalent to what rate per annum?

18. A man loaned another a sum of money, payable in 5 months, with interest at the rate of 6%, and at the end of that time received $666.25 in return. How much did he loan?

19. A speculator borrowed $10925 at 6%, May 16, 1882, with which he purchased flour at $6.25 per barrel. June 11, 1883, he sold the flour at $7.50 per barrel, cash. What did he gain by the transaction?

20. B bought 225 *A.* 24 *sq. rd.* of land, Aug. 18, 1882, at $4 an acre, borrowing the money to pay for it at 5%. He sold the land April 7, 1886, at an advance of $299.40 on cost. If meanwhile he paid $46.50 for taxes on the land, did he gain or lose, and how much?

21. A speculator bought 9000 bu. grain at $1.80 per bushel, Mar. 18, 1875, the money paid for it being borrowed at 5½%. Dec. 12, 1875, he sold ⅔ of the grain at $2.00 per bushel, and the remainder at $1.90 per bushel. What was gained or lost by the transaction?

22. A person buying a building lot for $5400, agreed to pay for it in four equal semi-annual installments, with interest at 6%; what was the total amount of money paid, the first payment being made at the time of the purchase?

23. A bill of goods amounting to $4316.75 is due May 27; how much would settle it May 1 at 6%? How much July 3?

84. A owes B £960 9s. 6d., with interest at 5%, for 143 days. He pays 25% of the amount due; how much remains?

NOTE. In England, interest is usually computed on the basis of 365 days to the year, when the time is given in days. The legal rate in England is 5%. To calculate interest on English money, reduce the shillings and pence to the decimal of a pound (see Art. 204, Ex. 7, Note), apply any of the methods under Art. 316, and reduce the resulting decimal to shillings and pence.

Find the accurate interest of

85. £433, from Aug. 4 to Dec. 28, at 5%.
86. £233 13s., from Jan. 13 to Apr. 1, at 4%.
87. £217 18s. 10d., from Mar. 3 to June 16, at 4½%.*
88. £439 10s. 8d., from Sept. 16 to Nov. 30, at 3%.
89. £316 18s. 6d., from Aug. 1 to Oct. 18, at 3½%.
90. £212 5s. 11d., from July 1 to Nov. 3, at 5%.
91. £233 15s. 9d., from Feb. 11 to Sept. 5, at 2½%.

92. A commission merchant sold 24150 pounds of leather at 29¼ cents a pound, paid transportation $60.40, storage $20, his commission being 2½%, and his charge for inspection $30. What were the net proceeds?

93. What per cent. profit does a merchant make who buys at a discount of [illegible] and [illegible]%, and sells at the list price?

94. At what per cent. above cost must goods be marked, so that [illegible] a discount of [illegible]%, there would be a profit of 25%?

95. A [illegible] a bill of goods amounting to $[illegible] on the following [illegible] months, or [illegible]% off for cash." He accepts the [illegible] the money at [illegible]% to pay the bill. How much [illegible]

96. [illegible] at $[illegible] each, less [illegible]%, and [illegible]% for cash. [illegible] discount may be given [illegible] profit [illegible]

[illegible]

[illegible]

[illegible]

ANNUAL INTEREST.

336. When a note contains the words "with interest annually," the laws of New Hampshire and Vermont, if the interest is not paid when due, allow simple interest on the annual interests from the time they become due to the time of payment.

Illustration.—A agrees to pay B, $6000 in three years from Jan. 1, 1880, with interest annually at 6%. By this contract, $360 becomes due Jan. 1, 1881, and on the first day of January in each year thereafter, until paid; this is the "annual interest." Suppose A does not pay any portion of this interest until Jan. 1, 1883, when the principal becomes due; then A, having had the use of money that his contract required him to pay to B, and B having been deprived of its use, B is entitled to have simple interest added to the annual interest, from the time when the same became due to Jan. 1, 1883; so that on Jan. 1, 1883, B would be entitled to the following sums as interest:

First year's int.	$360	+ 2 *yrs.* simple int. thereon,	$43.20 =	$403.20
Second " "	360	+ 1 " " " "	21.60 =	381.60
Third " "	360	+ 0 (paid when due)	00 =	360
	$1080		$64.80 =	$1144.80

Amount of annual interest	$1080.00
Amount of simple interest accrued upon annual interest .	64.80
Total amount of interest due	$1144.80

In calculating the simple int. upon the annual int., shorten the operation by finding the int. upon the annual int. for the sum of the several periods.

Ex. What is the amount due on the following note July 1, 1885?

$10000. Concord, N. H., *January 1, 1882.*

Three years after date, for value received, I promise to pay A. B. Thompson, or order, Ten Thousand Dollars, with interest payable annually.

C. A. Downs.

OPERATION.

Face of note, on interest from Jan. 1, 1882		$10000.00
Interest from Jan. 1, 1882, to July 1, 1885, 3 *yr.* 6 *mo.*		2100.00
3 items of annual interest ($600 each) are unpaid:		
1st from Jan. 1, 1883, to July 1, 1885,	2 *yr.* 6 *mo.*	
2nd from Jan. 1, 1884, to July 1, 1885,	1 *yr.* 6 *mo.*	
3rd from Jan. 1, 1885, to July 1, 1885,	6 *mo.*	
Int. on the annual int. = int. on $600 for 4 *yr.* 6 *mo.*		162.00
Total amount due July 1, 1885		$12262.00

337. RULE.—*To the given principal and its interest to the date of settlement, add the interest on each annual interest from the time it is due to the date of settlement. The sum will be the amount due at annual interest.*

EXAMPLES.

338. 1. At 6%, interest payable annually, how much would be due Oct. 1, 1884, according to the laws of New Hampshire, on a note of $8000, dated June 1, 1881, no payments having been made?

2. What amount would be due Jan. 1, 1886, at 6%, on a note for $4200, dated Concord, N. H., May 16, 1882, interest payable annually, and no payments having been made?

3. A note for $10000 was dated Apr. 1, 1882, and payable four years from date without interest. Attached to this note were 8 notes of $400 each for the semi-annual interest due Oct. 1, 1882, Apr. 1, 1883, Oct. 1, 1883, Apr. 1, 1884, Oct. 1, 1884, Apr. 1, 1885, Oct. 1, 1885, Apr. 1, 1886. How much was due Apr. 1, 1886, nothing having been paid?

NOTE.—[illegible] corporations when making loans for [illegible] bond and mortgage, to have [illegible] principal, and to have [illegible] semi-annual, or quarterly [illegible] payable. These notes [illegible] and may be collected without [illegible]

[illegible] 1884, on a note of $[illegible] 1882 [illegible] years, with notes for quar-[illegible]

[illegible] 1886, on a note of $3500, [illegible] semi-annual [illegible] having [illegible]

[illegible] annual [illegible] having [illegible]

[illegible]

COMPOUND INTEREST.

339. Compound Interest is interest not only on the principal, but on the interest also after it becomes due (**295**).

1. Interest may be compounded annually, semi-annually, quarterly, etc.

2. Interest upon interest due, or compound interest, cannot be collected by law, that is, payment cannot be enforced; but such a payment is equitable, and the receiving of it, if the debtor is willing or can be induced to pay it, does not constitute usury in the legal sense of the word. In the State of Missouri, parties may contract in writing for the payment of interest upon interest, but it shall not be compounded oftener than once a year.

Ex. What is the compound interest of $1000 for 3 years, at 6%?

OPERATIONS.

$1000.00	Principal.	Or	$1000
60.00	Interest for 1 *yr.*		1.06
1060	Amount for 1 *yr.*, or 2d principal.		1060
63.60	Interest of $1060 for 1 *yr.*		1.06
1123.60	Amount for 2 *yr.*, or 3d principal.		1123.60
67.416	Interest of $1123.60 for 1 *yr.*		1.06
1191.016	Amount for 3 *yr.*		1191.016
1000	Original principal.		1000
191.016	Compound interest for 3 *yr.*		191.016

340. RULE.—*Find the amount of the given principal for the first period of time, and make it the principal for the second. Find the amount of the second principal for the second period of time, and make it the principal for the third; and so continue for the whole time. The last amount is the amount required.*

The last amount, less the given principal, will be the compound interest.

NOTES.—1. When the time is not a multiple of the interest period, find the amount of the principal to the end of the last period; then compute the simple interest on this amount for the remaining time, and add it to the last amount. The sum will be the required amount.

2. The work of computing compound interest may be shortened by using the tables on pages 140 and 141.

1. Table showing the sum to which $1 will increase, at compound est, in any number of years not exceeding 45.

Yrs.	2%.	2½%.	3%.	3½%.	4%.	4½%.	5%.	6%.	7%.	Yrs.
1	1.0200	1.0250	1.0300	1.0350	1.0400	1.0450	1.0500	1.0600	1.0700	1
2	1.0404	1.0506	1.0609	1.0712	1.0816	1.0920	1.1025	1.1236	1.1449	2
3	1.0612	1.0769	1.0927	1.1087	1.1249	1.1412	1.1576	1.1910	1.2250	3
4	1.0824	1.1038	1.1255	1.1475	1.1699	1.1925	1.2155	1.2625	1.3108	4
5	1.1041	1.1314	1.1593	1.1877	1.2167	1.2462	1.2763	1.3382	1.4026	5
6	1.1262	1.1597	1.1941	1.2293	1.2653	1.3023	1.3401	1.4185	1.5007	6
7	1.1487	1.1887	1.2299	1.2723	1.3159	1.3609	1.4071	1.5036	1.6058	7
8	1.1717	1.2184	1.2668	1.3168	1.3686	1.4221	1.4775	1.5938	1.7182	8
9	1.1950	1.2489	1.3048	1.3629	1.4233	1.4861	1.5513	1.6895	1.8385	9
10	1.2190	1.2801	1.3439	1.4106	1.4802	1.5530	1.6289	1.7908	1.9672	10
11	1.2434	1.3121	1.3842	1.4600	1.5395	1.6229	1.7103	1.8983	2.1049	11
12	1.2682	1.3449	1.4258	1.5111	1.6010	1.6959	1.7956	2.0122	2.2522	12
13	1.2936	1.3785	1.4685	1.5640	1.6651	1.7722	1.8856	2.1329	2.4098	13
14	1.3195	1.4130	1.5126	1.6187	1.7317	1.8519	1.9799	2.2609	2.5785	14
15	1.3459	1.4483	1.5580	1.6753	1.8009	1.9353	2.0789	2.3966	2.7590	15
16	1.3728	1.4845	1.6047	1.7340	1.8730	2.0224	2.1829	2.5404	2.9522	16
17	1.4002	1.5216	1.6528	1.7947	1.9479	2.1134	2.2920	2.6928	3.1588	17
18	1.4282	1.5597	1.7024	1.8575	2.0258	2.2085	2.4066	2.8543	3.3799	18
19	1.4568	1.5987	1.7535	1.9225	2.1068	2.3079	2.5270	3.0256	3.6165	19
20	1.4859	1.6386	1.8061	1.9898	2.1911	2.4117	2.6533	3.2071	3.8697	20
21	1.5157	1.6796	1.8603	2.0594	2.2788	2.5202	2.7860	3.3996	4.1406	21
22	1.5460	1.7216	1.9161	2.1315	2.3699	2.6337	2.9253	3.6035	4.4304	22
23	1.5769	1.7646	1.9736	2.2061	2.4647	2.7522	3.0715	3.8197	4.7405	23
24	1.6084	1.8087	2.0328	2.2833	2.5633	2.8760	3.2251	4.0489	5.0724	24
25	1.6406	1.8539	2.0938	2.3632	2.6658	3.0054	3.3864	4.2919	5.4274	25
26	1.6734	1.9003	2.1566	2.4460	2.7725	3.1407	3.5557	4.5494	5.8074	26
27	1.7069	1.9478	2.2213	2.5316	2.8834	3.2820	3.7335	4.8223	6.2139	27
28	1.7410	1.9965	2.2879	2.6202	2.9987	3.4297	3.9201	5.1117	6.6488	28
29	1.7758	2.0464	2.3566	2.7119	3.1187	3.5840	4.1161	5.4184	7.1143	29
30	1.8114	2.0976	2.4273	2.8068	3.2434	3.7453	4.3219	5.7435	7.6123	30
31	1.8476	2.1500	2.5001	2.9050	3.3731	3.9139	4.5380	6.0881	8.1451	31
32	1.8845	2.2038	2.5751	3.0067	3.5081	4.0900	4.7649	6.4534	8.7153	32
33	1.9222	2.2589	2.6523	3.1119	3.6484	4.2740	5.0031	6.8406	9.3253	33
34	1.9607	2.3153	2.7319	3.2209	3.7943	4.4664	5.2533	7.2510	9.9781	34
35	1.9999	2.3732	2.8139	3.3336	3.9461	4.6673	5.5160	7.6861	10.6766	35
36	2.0399	2.4325	2.8983	3.4503	4.1039	4.8774	5.7918	8.1473	11.4239	36
37	2.0807	2.4933	2.9852	3.5710	4.2681	5.0969	6.0814	8.6361	12.2236	37
38	2.1223	2.5557	3.0748	3.6960	4.4388	5.3262	6.3855	9.1543	13.0793	38
39	2.1647	2.6196	3.1670	3.8254	4.6164	5.5659	6.7048	9.7035	13.9948	39
40	2.2080	2.6851	3.2620	3.9593	4.8010	5.8164	7.0400	10.2857	14.9745	40
41	2.2522	2.7522	3.3599	4.0978	4.9931	6.0781	7.3920	10.9029	16.0227	41
42	2.2972	2.8210	3.4607	4.2413	5.1928	6.3516	7.7616	11.5570	17.1443	42
43	2.3432	2.8915	3.5645	4.3897	5.4005	6.6374	8.1497	12.2505	18.3444	43
44	2.3901	2.9638	3.6715	4.5433	5.6165	6.9361	8.5572	12.9855	19.6285	44
45	2.4379	3.0379	3.7816	4.7024	5.8412	7.2482	8.9850	13.7646	21.0025	45

To find the sum to which a given amount will increase, at compound interest, at any of the rates per cent. and number of years expressed in the above Table:

Multiply the given amount by the sum to which one dollar will increase at the rate and for the number of years required, marking off as many decimals from the product as there are decimals in the multiplier and multiplicand.

NOTES.—1. The amount for any number of years not given in the table may be computed by finding the product for any two numbers of years whose sum equals the given time. Thus, the compound amount of $1 at 6% for 55 years, may be found by multiplying $13.7646, the amount for 45 years, by 1.7908, the amount for 10 years.

2. If the interest is compounded semi-annually, to find the amount from the table, take twice the number of years at one-half the rate. Thus, the amount at 8%, compounded semi-annually, for 5 years, is equivalent to the amount for 10 periods of 6 months each, at 4% for each period, and is the same as the amount for 10 years at 4%. If the interest is compounded quarterly, take 4 times the number of years at one-fourth the rate.

3. The compound interest of $1 is $1 less than the amounts in the above table.

342. Table showing the sum to which $1, paid at the beginning of each year will increase at compound interest, in any number of years not exceeding 50.

Yrs.	3%.	3½%.	4%.	5%.	6%.	7%.	8%.	10%.	Yrs.
1	1.0300	1.0350	1.0400	1.0500	1.0600	1.0700	1.0800	1.1000	1
2	2.0909	2.1062	2.1216	2.1525	2.1835	2.2149	2 2464	2.3100	2
3	3.1836	3.2149	3.2465	3.3101	3,3746	3.4399	3.5061	3.6410	3
4	4.3091	4.3625	4.4163	4.5256	4.6371	4.7507	4.8666	5.1051	4
5	5.4684	5.5502	5.6330	5.8019	5.9753	6.1533	6.3359	6.7156	5
6	6.6625	6.7791	6.8983	7.1420	7.3938	7.6540	7.9228	8.4872	6
7	7.8923	8.0517	8.2142	8.5491	8.8975	9.2598	9.6366	10.4359	7
8	9.1591	9.3685	9.5828	10.0266	10.4913	10.9780	11.4876	12.5795	8
9	10.4639	10 7314	11.0061	11.5779	12.1808	12.8164	13.4866	14.9374	9
10	11.8078	12.1420	12.4864	13.2068	13.9716	14.7836	15.6455	17.5312	10
11	13.1920	13.6020	14 0258	14.9171	15.8699	16.8885	17.9771	20.3843	11
12	14.6178	15 1130	15.6268	16.7130	17.8821	19.1406	20.4952	23.5227	12
13	16.0863	16.6770	17.2919	18.5986	20.0151	21.5505	23.2149	26.9750	13
14	17.5989	18.2957	19.0236	20.5786	22.2760	24.1290	26.1521	30.7725	14
15	19.1569	19.9710	20.8245	22.6575	24.6705	26.8881	29.3243	34.9497	15
16	20.7616	21.7050	22.6975	24.8404	27.2129	29.8402	32.7502	39,5447	16
17	22.4144	23.4997	24.6454	27.1324	29.9057	32.9990	36.4502	44.5992	17
18	24.1169	25.8573	26 6712	29.5390	32.7600	36.3790	40.4463	50.1591	18
19	25.8704	27.2797	28.7781	32.0630	35.7856	39.9955	44.7620	56.2750	19
20	27.6765	29.2695	30.9692	34 7193	38.9927	43.8652	49.4229	63.0025	20
21	29.5368	31.3290	33.2480	37.5052	42.3923	48.0058	54.4568	70.4027	21
22	31.4529	33.4604	35.6179	40.4305	45.9958	52.4361	59.8963	78.5430	22
23	33.4265	35.6665	38.0826	43.5020	49.8156	57.1767	65.7648	87.4973	23
24	35.4593	37.9499	40.6459	46.7271	53.8645	62.2490	72.1059	97.3471	24
25	37.5530	40.3131	43.3117	50.1135	58.1564	67.6765	78.9544	108.1818	25
26	39.7096	42.7591	46.0842	53.6961	62.7058	73.4838	86.3508	120.0999	26
27	41.9309	45.2906	48.9676	57.4026	67.5281	79.6977	94.3388	133.2099	27
28	44.2188	47.9108	51.9663	61.3227	72.6398	86.3465	102.9659	147.6309	28
29	46.5754	50.6227	55.0849	65.4388	78.0582	93.4608	112.2832	163.4940	29
30	49.0027	53-4295	58.3283	69.7608	83.8017	101.0730	122.3459	180.9434	30
31	51.5028	56.3345	61.7015	74.2988	89 8898	109.2182	133.2135	200.1378	31
32	54.0778	59.3412	65.2095	79.0638	96.3432	117.9334	144.9506	221.2515	32
33	56.7302	62.4532	68.8579	84.0670	103.1838	127.2588	157.6267	244.4767	33
34	59.4621	65.6740	72.6522	89.3203	110.4348	137.2369	171.3168	270.0244	34
35	62.2719	69.0076	76.5983	94.8363	118.1209	147.9135	186.1021	298.1268	35
36	65.1742	72.4579	80 7022	100.6281	126.2681	159.3374	202.0703	329.0395	36
37	68.1594	76.0289	84.9703	106.7095	134.9042	171.5610	219.3159	363.0434	37
38	71.2342	79.7249	89.4091	113.0950	144.0535	184.6403	237.9412	400.4478	38
39	74.4013	83.5503	94.0255	119.7998	153.7620	198.6351	258.0565	441.5926	39
40	77.6633	87.5095	98.8265	126.8398	164.0477	213.6096	279.7810	486.8518	40
41	81.0232	91.6074	103.8196	134.2318	174.9506	229.6322	303.2435	536.6370	41
42	84.4839	95.8486	109.0124	141.9933	186.5076	246.7765	328.5830	591.4007	42
43	88.0484	100.2383	114.4129	150.1430	198.7580	265.1208	355.9496	651.6408	43
44	91.7199	104.7817	120.0294	158.7002	211 7435	284.7493	385.5056	717.9048	44
45	95.5015	109 4840	125 8706	167.6852	225.5081	305.7518	417.4261	790.7953	45
46	99.3965	114.3510	131.9454	177.1194	240.0986	328,2244	451.9002	870.9749	46
47	103.4084	119.3883	138.2632	187.0254	255.5645	352.2701	489.1322	959.1723	47
48	107.5406	124.6018	144.8337	197.4267	271.9584	377.9990	529.3427	1056·1896	48
49	111.7969	129.9979	151.6671	208.3480	289.3359	405.5289	572.7702	1162.9085	49
50	116.1307	135.5828	158.7738	219.8154	307.7561	434.9859	619.6718	1280.2993	50

To find the sum to which a given amount, per annum, will increase at compound interest, at any of the rates per cent. and number of years expressed in the above Table:

Multiply the given amount, per annum, by the sum to which one dollar per annum will increase at the rate and for the number of years required, marking off as many decimals from the product as there are decimals in the multiplier and multiplicand.

NOTE.—If the amount be payable semi-annually, and compound interest is to be allowed semi-annually, take the amount for double the number of years at one-half the rate per cent. Thus, for a semi-annual payment of $1 for 10 years at 10 per cent., take the amount of $1 for 20 years at 5 per cent. = $34.7193. For a quarterly payment, take the amount for four times the number of years at one-fourth the rate per cent.

EXAMPLES.

343. 1. What will $450 amount to at compound interest, in 4 years, compounded annually at 4%? At 3%?

2. Find the compound interest of $360, for 2 years, interest compounded semi-annually at 6%. At 5%.

3. What is the compound interest of $800 for 1 *yr.* 3 *mo.* at 8%, interest compounded quarterly?

4. At compound interest, what is the amount of $1728 for 3 *yr.* 4 *mo.* 18 *da.*, interest compounded annually at 3%? At 6%?

NOTE.—First find the amount for 3 years, and use this amount as the principal for the remaining time.

5. B holds a mortgage against A's property dated Apr. 1, 1881, for $2000, interest payable annually at 6%. The interest due Apr. 1, 1882, is not paid until May 26, 1882. How much is then due, A having consented to pay interest upon interest? (See Note 3, Art. 330).

NOTE.—In solving the following examples, use the tables in Art. 341-342.

6. A gentleman deposits in a savings bank $100 when his child is one year old. How much will this amount to when he is 21 years old, interest being compounded semi-annually at 4%? At 5%?

7. If at the age of 35 years, a person places $2000 on interest, compounded annually at 6%, what will be the amount due him when he is 50 years old?

8. What will $635 amount to at compound interest, in 36 years, compounded annually at 3%? At 4%?

9. At the age of 30, and every year thereafter, a young man places $200 at compound interest at 6%. How much will he have at the age of 50? At the age of 40? (See Art. 342.)

10. How much will a gentleman have at the end of three years, if he places at compound interest at 5%, $300 at the beginning of each year?

11. Mr. B., whose life is insured for $4000, pays an annual premium of $[illegible]. How much would this amount to at 6% compound interest in 20 years?

12. A lady deposits $50 in a savings bank Jan. 1 and July 1, of each year. How much [illegible] credited to her credit in 15 years, money [illegible] compound interest?

13. What sum must be placed at compound interest, at 6%, to amount to $1000 in 5 years?

NOTE.—In compound interest, as in simple interest, the amounts are proportional to the principals; hence the amount of any principal is as many times greater than the amount of $1, as that principal is greater than $1.

To find the principal, divide the given amount by the amount of $1 for the given time and rate.

In simple interest, the interest on a given principal for a given time is in proportion to the rate per cent., and at a given rate, in proportion to the time; but, in compound interest, such is not the case. If the rate or time be doubled, the interest is more than doubled.

14. How much should a gentleman invest at compound interest, 6%, for his son who is now 6 years old, so that, when he becomes 21 years of age, he may have $10000?

15. In the above example, how much should be invested at the beginning of each year to produce the same sum?

16. A gentleman at his death left $7850 for the benefit of his only son, 12 years old, the money to be paid to him when he should be 21 years of age. How much did he receive, interest at 6%, compounded semi-annually?

17. How much must a person at the age of 25 years, place at compound interest at 6%, so that the amount due him, when he is 50 years old, will be $20000?

18. In the above example, how much should he invest annually to produce the same sum?

COMMERCIAL PAPER.

344. Commercial Paper embraces notes, drafts, bills of exchange, etc.

345. A **Note** (also called a Promissory Note) is a written promise to pay a certain sum of money on demand or at a specified time.

346. The **Maker** of a note is the person who signs it, and thus becomes responsible for its payment. The **Payee** is the person to whom, or to whose order, it is made payable. The **Face** of a note is the sum promised.

In Note 1, Art. **352**, Peter Cooper is the maker; George Peabody is the payee; the face of the note is $1000.

347. A **Negotiable Note** is a note which is made payable to bearer or to the order of some person (See Notes, Art. 352).

1. A note is *non-negotiable* when it is payable only to the party named in the note.

2. A negotiable note made in New Jersey must contain the words "without defalcation or discount;" in Missouri, the words "negotiable and payable without defalcation or discount."

3. Negotiable notes payable to order may be sold or transferred by the payee writing his name upon the back of the note. He then becomes an indorser.

348. The **Indorser** of a note or draft is the person who writes his name on the back of it, and by so doing guarantees its payment.

1. If Mr. Thomas Fleming desires to sell or transfer Note 3, Art. 352, it will be necessary for him to indorse it. If he writes his name only, it is called an indorsement *in blank*, and the note is then payable without further indorsement to any person lawfully holding the same. He may indorse it *in full* by making it payable to a particular person, thus—"Pay to the order of Henry A. Putnam, Thomas Fleming." Before it can be again transferred, it will require the indorsement of Henry A. Putnam. For greater security, checks, notes, drafts, etc., are indorsed in full when sent by mail.

2. If an indorser does not wish to guarantee the payment of a note, draft, etc., he writes "Without recourse" over his name at the time of the indorsement.

3. Sometimes notes and drafts are drawn to the order of the maker or the drawer [illegible] to facilitate their transfer without the indorsement of the holder.

349. A **Draft** or **Bill of Exchange** is an order or request written by one person to another directing the payment of a specified sum of money to a third person or to his order.

350. The **Drawer** of the draft is the person who signs it. The **Drawee** is the person on whom it is drawn. The **Payee** is the person to whom or to whose order it is made payable.

1. [illegible] Art. 352, [illegible] Huntington is the drawer; Drexel, Morgan [illegible] J. & W. Seligman & Co. are the payees.

2. The person on whom a bill is drawn is sometimes called the [illegible]. After the bill is presented and accepted, [illegible] the acceptor, and the draft an acceptance. The draft [illegible] legal significance as a promissory note.

3. [illegible] by writing the word [illegible] the date over his name across its face.

3. Drafts are sometimes accepted in the following form:—"Accepted August 20, 1881, and payable at the National Park Bank, New York, G. B. Horton & Co."

4. In the State of New York, both by law and custom, the drawee of a draft may demand 24 hours consideration from the time the draft is presented for acceptance.

When accepted, it must bear the date when first seen by him.

5. To "honor" a draft is to accept it or pay it on being presented.

351. A **Protest** is a formal statement made by a Notary Public, declaring that a draft or note has been presented for payment or acceptance, and was refused.

352. FORMS OF NOTES AND DRAFTS.

1. DEMAND NOTE.

$1000. NEW YORK, *August 19, 1881.*

On demand, I promise to pay GEORGE PEABODY, or bearer, One Thousand Dollars. Value received.

PETER COOPER.

The above note is payable on demand,—that is, whenever presented; is negotiable (payable to bearer); and bears interest from date at the legal rate of the State in which it is made. If the words "or bearer" were omitted the note would not be negotiable.

2. TIME NOTE—INTEREST-BEARING.

875\frac{44}{100}$. CINCINNATI, OHIO, *July 16, 1882.*

Six months after date, I promise to pay GEO. C. MILLER, or order, Eight Hundred Seventy-five and $\frac{44}{100}$ Dollars, with interest at eight per cent. Value received.

ALEX. MCDONALD.

The above note is payable 6 *mo.* 3 *da.* after its date, or Jan. 19, 1883; is negotiable (payable to order); and draws interest from its date at 8% per annum. If the rate of interest was omitted, it would bear interest at the legal rate of the State for such cases, 6%. (See Art. **298.**)

3. TIME NOTE—WITHOUT INTEREST—PAYABLE AT A BANK.

$6000. ALBANY, N. Y., *December 4, 1881.*

Sixty days after date, I promise to pay to the order of ERASTUS CORNING, Six Thousand Dollars, at the Second National Bank. Value received.

E. C. KOONZ.

347. A **Negotiable Note** is a note which is made payabl bearer or to the order of some person (See Notes, Art. **352**).

1. A note is *non-negotiable* when it is payable only to the party name the note.

2. A negotiable note made in New Jersey must contain the words "w out defalcation or discount;" in Missouri, the words "negotiable and pay without defalcation or discount."

3. Negotiable notes payable to order may be sold or transferred by payee writing his name upon the back of the note. He then becomes indorser.

348. The **Indorser** of a note or draft is the person w writes his name on the back of it, and by so doing guarant its payment.

If Mr. Erastus Corning desires to sell or transfer Note 3, Art. 352 will be necessary for him to indorse it. If he writes his name only, it is cal an indorsement *in blank*, and the note is then payable without further indo ment to any person lawfully holding the same. He may indorse it *in full* making it payable to a particular person, thus—"Pay to the order of H R. Pierson, Erastus Corning." Before it can be again transferred, it require the indorsement of Henry R. Pierson. For greater security, ch notes, drafts, etc., are indorsed in full when sent by mail.

If an indorser does not wish to guarantee the payment of a note, etc., he writes "Without recourse" over his name at the time of the ment.

Sometimes notes and drafts are drawn to the order of the maker drawer (to the order of myself or ourselves) to facilitate their transfer the indorsement of the holder.

349. A **Draft, or Bill of Exchange** is an order or addressed by one person to another directing the payme specified sum of money to a third person or to his order.

350. The **Drawer** of the draft is the person who The **Drawee** is the person on whom it is drawn. Tl is the person to whom, or to whose order, it is made pay

In Draft 5, Art. **352**, C. P. Huntington is the drawer; Dre the drawees; J. & W. Seligman & Co. are the pa favor the bill is drawn is [illegible]

4. A note or draft must be presented at the place where it is made payable. If at a bank, during banking hours; if at a place of business, during business hours; if at a residence, during family hours; and if the maker, or some one for him, is not ready with legal tender currency to pay it, the holder need not call again. A check, even if certified, is not a legal tender, and may be lawfully refused.

353. Days of Grace and Maturity.—The day of maturity is the day on which a note becomes legally due. According to the laws of most of the States, a note is not legally due until three days after the expiration of the time specified in the note, except the note contain the words "without grace." These days are called *days of grace*, but they are of no advantage to the payer, since interest is charged for them as for any others.

1. California has abolished days of grace altogether. In Georgia, Alabama, and Kentucky, grace is allowed on promissory notes only in case they are made payable, or are discounted or left for collection at a bank or private banker's. (March, 1879.)

2. By statute in the State of New York and most of the States, all bills and notes due on Sunday are payable on Saturday, and all due on a legal holiday are made payable on the business or secular day next preceding. Thus, if a holiday falls on Thursday, all notes, etc., must be paid on Wednesday; if a holiday falls on Monday, all notes due Sunday or Monday would be payable on Saturday; if a holiday falls on Saturday, notes due Saturday or Sunday would be payable on Friday.

3. The legal holidays in the State of New York are New Year's Day (Jan. 1), Washington's Birthday (Feb. 22), Decoration Day (May 30), Independence Day (July 4), Election Day (the first Tuesday after the first Monday in November), Thanksgiving Day (the day appointed by the President of the United States and Governor of the State, usually the last Thursday of November), and Christmas (Dec. 25).

4. When a legal holiday falls on Sunday, Monday is, by the statute of New York, made a legal holiday, and notes, etc., maturing on Sunday or Monday, must be paid on the preceding Saturday.

5. A note made due at a fixed date in the future, carries 3 days' grace (unless the words "without grace" are used in the contract. Thus, a note stating that "on May 1, 1882, I promise, etc.," would carry 3 days' grace, and would be payable May 4, 1882.

6. When the time of a note is expressed in months, calendar months are used to determine the day of maturity; when in days, the exact number of lays is used.

Thus, a note dated July 16, and payable two months from date, would ominally mature Sept. 16, and, including the three days of grace, would gally mature Sept. 19. A note having the same date, and payable

The preceding note is payable 63 days from Dec. 4, 1881, or Feb. 5, 1882. It is payable at the Second National Bank. No interest will be due at maturity (Feb. 5). If the note is not paid at maturity, it will bear interest from that date.

4. JOINT AND SEVERAL NOTE.

$416\frac{32}{100}$. WORCESTER, MASS, *May 27, 1882.*

Four months after date, we jointly and severally promise to pay JOHN S. BALLARD & CO., or order, Four Hundred Sixteen $\frac{32}{100}$ dollars, with interest from date, value received.

T. K. EARLE.
CHAS. W. SMITH.

If the above note were written "we jointly promise, etc.," it would be called a *joint note*. The makers of a joint note must be sued jointly, each being responsible for one-half of the amount of the note. The makers of a joint and several note may be sued separately, either being responsible for the full amount of the note.

5. SIGHT DRAFT.

$8000. SAN FRANCISCO, CAL., *May 1, 1882.*

At sight, pay to the order of J. & W. SELIGMAN & Co., Eight Thousand Dollars, value received.

C. P. HUNTINGTON.

To DREXEL, MORGAN & CO., New York.

6. TIME DRAFT.

$5000. BURLINGTON, IOWA, *June 18, 1881.*

At sixty days' sight, pay to the order of ADDISON BALLARD, Five Thousand Dollars, value received, and charge to account of

A. G. ADAMS.

To BARTON & JONES, Chicago, Ill.

Drafts are sometimes drawn a certain number of "days after date."

For Foreign Bills of Exchange, see Art. 418.

NOTES.—1. A note should contain the words "Value received," as a contract without a consideration is not legally binding.

2. Negotiable securities are good in the hands of one who purchases in good faith and before maturity, although the seller may have found or stolen them.

3. Where no place of payment is specified, a promissory note is payable at the maker's place of business, or if none is known, at the residence of the maker.

4. A note or draft must be presented at the place where it is made payable. If at a bank, during banking hours; if at a place of business, during business hours; if at a residence, during family hours; and if the maker, or some one for him, is not ready with legal tender currency to pay it, the holder need not call again. A check, even if certified, is not a legal tender, and may be lawfully refused.

353. Days of Grace and Maturity.—**The day of maturity** is the day on which a note becomes legally due. According to the laws of most of the States, a note is not legally due until three days after the expiration of the time specified in the note, except the note contain the words "without grace." These days are called *days of grace*, but they are of no advantage to the payer, since interest is charged for them as for any others.

1. California has abolished days of grace altogether. In Georgia, Alabama, and Kentucky, grace is allowed on promissory notes only in case they are made payable, or are discounted or left for collection at a bank or private banker's. (March, 1879.)

2. By statute in the State of New York and most of the States, all bills and notes due on Sunday are payable on Saturday, and all due on a legal holiday are made payable on the business or secular day next preceding. Thus, if a holiday falls on Thursday, all notes, etc., must be paid on Wednesday; if a holiday falls on Monday, all notes due Sunday or Monday would be payable on Saturday; if a holiday falls on Saturday, notes due Saturday or Sunday would be payable on Friday.

3. The legal holidays in the State of New York are New Year's Day (Jan. 1), Washington's Birthday (Feb. 22), Decoration Day (May 30), Independence Day (July 4), Election Day (the first Tuesday after the first Monday in November), Thanksgiving Day (the day appointed by the President of the United States and Governor of the State, usually the last Thursday of November), and Christmas (Dec. 25).

4. When a legal holiday falls on Sunday, Monday is, by the statute of New York, made a legal holiday, and notes, etc., maturing on Sunday or Monday, must be paid on the preceding Saturday.

5. A note made due at a fixed date in the future, carries 3 days' grace (unless the words "without grace" are used in the contract). Thus, a note stating that "on May 1, 1882, I promise, etc.," would carry 3 days' grace, and would be payable May 4, 1882.

6. When the time of a note is expressed in months, calendar months are used to determine the day of maturity; when in days, the exact number of days is used.

Thus, a note dated July 16, and payable two months from date, would nominally mature Sept. 16, and, including the three days of grace, would legally mature Sept. 19. A note having the same date, and payable sixty days from date, would nominally mature Sept. 14, and, including the three days of grace, would legally mature Sept. 17.

7. A note due in one or more months from date, matures on the corresponding day of the month up to which it is reckoned, *if there are so many days in that month*; but if not so many, it then matures on the last day of said month, to which the usual grace must be added. Thus, notes dated Jan 28, 29, 30, or 31, and payable one month from date, would become due Mar. 3 (Feb. 28 with 3 days' grace added).

8. When drafts are payable a certain time after *sight*, the date of acceptance and the time of the draft determine the day of maturity. Thus, if a draft is dated May 16, accepted May 20, and payable sixty days after sight, it would mature or be due 63 (including 3 days of grace) days after May 20, or July 22. If payable 60 days after *date*, it would mature 63 days after May 16, or July 18. It is not necessary to present for acceptance drafts drawn a certain time after date, but as a courtesy to the drawee, it is usually done.

9. Days of grace are allowed on drafts according to the custom of the place where they are payable. The statute of New York forbids grace on all sight drafts, no matter on whom drawn, and on all time drafts which appear on their face to be drawn "upon any bank, or upon any banking association or individual banker, carrying on the banking business under the act to authorize the business of banking."

EXAMPLES.

354. 1. How much would be due on Note 1, Art. **352**, Jan. 1, 1882, finding the time by compound subtraction?

2. How much would be due on Note 2, Art. **352**, at its maturity? How much March 1, 1883? Supposing the rate of interest was omitted in the note, how much would be due May 4, 1883?

3. Ninety days after June 21 is what date?

OPERATIONS.

90		Or	9	June.
9	June.		31	July.
81			31	Aug.
31	July.		71	
50			19	
31	Aug.		19	Sept.
19	Sept.			

ANALYSIS.—Subtract from the given number of days, the number of days remaining in June, and from this remainder, subtract successively the number of days in the following months until the remainder is equal to or less than the number of days in the next following month. The last remainder represents the required date.

Or, write the remaining number of days in June, and the number of days in [illegible] given number of days. Take their [illegible] from the given number of days. The remainder [illegible] following month representing the required date. [illegible] given number, subtract the excess from the number of days in the last month written. The remainder will be the required date.

If the time be 30, 60, or 90 days, regard each 30 days as a calendar month, and correct by subtracting 1 day for each intervening month containing 31 days, and adding 2 days for February (in leap year 1 day). Thus 3 months after June 21 is Sept. 21, and by subtracting 2 days for July and August, the correct result is Sept. 19.

4. Supposing Note 3, Art. **352**, was payable 90 days from date, what would be its due date? The note as given not being paid at maturity, how much would be due Feb. 25, 1882, protest fees $2.10?

5. How much would settle Note 4, Art. **352**, Dec. 30, 1882?

6. If Draft 6, Art. **352**, was accepted June 19, 1881, what was the date of maturity?

BANK DISCOUNT.

355. Bank Discount is simple interest of a note, paid in advance, for the number of days the note has to run. It may be computed by any of the methods given for simple interest.

On notes without interest (the usual case of notes discounted at banks), bank discount is reckoned on their face, the amount due at maturity; on notes with interest, it is reckoned on the amount due at maturity, or their face plus the interest for the full time of the note.

356. The **Proceeds** of a note is the amount received by the holder from the bank when the note is discounted. It is the amount on which the discount is reckoned less the discount.

357. Call Loans.—Banks in the City of New York loan large amounts of money upon stocks, bonds, etc., as collateral security, payable on demand or on giving one day's notice. Such loans are called "call" or demand loans, and interest on them is paid at the end of the time.

358. The time to be reckoned on a loan or note is exclusive of the day of date, but includes the day of maturity or payment. Thus, in discounting a note in the City of New York, Apr. 4, which would mature Apr. 24, the discount would be calculated for 20 days.

In Philadelphia, Baltimore and other cities it is the custom of banks in finding time to include both the day of discount and the day of maturity. Thus, the discount on the above note would be reckoned for 21 days.

359. Banks of the City of New York reckon discount both on the basis of 360 and 365 days to the year.

NOTE.—In April 1880, the author made a personal investigation of this subject among the 70 banks of the City of New York, and found that their methods were not uniform; some banks reckoning discount on the basis of 365 days to the year, and others on the basis of 360 days. It is the custom of brokers and dealers in commercial paper to reckon interest and discount on the basis of 360 days to the year. Below are given extracts from letters received from some of the above banks.

"In discounting notes, we reckon interest on the basis of 365 days to the year when at 6%; 360 when at a rate lower than legal interest."

"In buying paper from a broker, we reckon on the basis of 360 days, no matter what the rate of discount."

"If we buy notes absolutely—without any recourse to the seller—as we frequently do of note-brokers and dealers in commercial paper—the usage is for banks to take, and brokers to allow, interest for the days to run to maturity on the basis of 360 days to the year."

"In discounting notes we reckon interest on the basis of 365 days to the year, while in making 'Call Loans' (367) the basis of reckoning is 360 days."

"All business with 'Wall St.' on stock loans, whether on demand or time, is calculated on the basis of 360 days to the year."

EXAMPLES.

360. Find the date of maturity and proceeds of the following notes:

(*1.*)

$10000. NEW YORK, *July 16, 1881.*

Four months after date, I promise to pay to the order of FISK & HATCH, Ten Thousand Dollars, at the First National Bank, value received.

S. D. BABCOCK.

Discounted July 16, 1881, at 6%.

ANALYSIS. The note is due 4 months (**353**, 6) and 3 days (days of grace, **353**) after July 16, or Nov. 19. From the day of discount (July 16) to the day of maturity (Nov. 19) there are 126 days.

The interest of $10000 for 126 days at 6%, if reckoned on the basis of 360 days to the year, is $210, and the proceeds are $10000 less $210, or $9790.

The interest on the basis of 365 days to the year would be $2.88 less, or $207.12, and the proceeds would be $9792.88.

If the note was discounted Sept. 1, the interest or discount would be reckoned for 79 days (Sept. 1 to Nov. 19).

(2.)

$8000. BROOKLYN, N. Y., *July 16, 1881.*

Ninety days from date, I promise to pay S. B. CHITTENDEN, or order, Eight Thousand Dollars, value received.

A. A. LOW.

Discounted Aug. 31, 1881, at 6%.

ANALYSIS.—The note is due 93 days (**353**, 6) after July 16, or Oct. 17. Compute the discount for 47 days (Aug. 31 to Oct. 17) on $8000.

If the note had been discounted July 16, the date of the note, the interest would have been computed for 93 days, the full time of the note.

NOTE.—The results of the following examples will be given on the basis of both 360 and 365 days to the year.

No.	Date of Note.	Time.	Face.	Date of Discount.	Rate of Discount
3	Jan. 24.	90 days	$1200	Jan. 24..........	6%
4	May 18..........	3 mo.	$5280	May 18..........	6%
5	Aug. 31..........	60 days	$2560	Aug. 31.........	8%
6	June 4...........	4 mo.	$3756	June 4...........	7%
7	Oct. 16.	30 days	$6425	Oct. 16..........	5%
8	Mar. 13..........	6 mo.	$8375	Mar. 13..........	5½%
9	May 29..........	3 mo.	$4500	July 7...........	10%
10	July 27..........	60 days	$8240	Sept. 2..........	6%
11	Mar. 28..........	90 days	$4324	Apr. 14..........	5¼%
12	May 27..........	6 mo.	$4885	Aug. 15..........	8%
13	Jan. 3...........	120 days	$9000	Feb. 28..........	6%
14	Sept. 12.	4 mo.	$5000	Oct. 14.	7%
15	Nov. 1...........	90 days	$6000	Nov. 28..........	5⅘%

Required the proceeds and date of maturity of the following notes discounted (360 days to the year) through a broker, his commission being ¼% of the face of the notes.

No.	Date of Note.	Time.	Face.	Date of Discount.	Rate of Discount
16	Feb. 21....... ..	4 mo.	$10000	Feb. 21..........	4¾%
17	June 8...........	4 mo.	$6000	June 12..........	4½%
18	Jan. 10..........	4 mo.	$6000	Jan. 10..........	4¼%
19	Mar. 3...........	6 mo.	$8775	Apr. 30..........	4¾%

20. What were the proceeds of Note 3, Art. **352**, if discounted Dec. 16, 1881, at the legal rate?

[illegible] the date of maturity and proceeds of a note of [illegible], [illegible] days from date, dated and discounted at a Philadelphia bank [illegible] (Ans. [illegible])

[illegible] the date of maturity and proceeds of a note of $3750, [illegible] days [illegible] date, dated and discounted at a Maryland bank [illegible] 483

[illegible] discounts a note payable in 6 months at 4½%. [illegible] is equivalent to what rate of [illegible] allowance for the days of grace?

[illegible] discounts a note at his bank at 6%, [illegible] through a broker at 4½%. Bill days to the [illegible] commission [illegible] How much better is the latter [illegible] of [illegible] payable in 6 months, dated and [illegible]

[illegible] the date of maturity and proceeds of the following [illegible]

[illegible]

[illegible] [illegible] [illegible], September 15, 1881.

[illegible] months after date [illegible] promise to pay T. J. Kline or order [illegible] Dollars with interest at 5%, value received.

J. M. Thomas.

[illegible] Nov. [illegible] at [illegible]

[illegible] discount at [illegible] on [illegible] days Nov. [illegible] to Jan. [illegible] on [illegible] maturity [illegible] plus the interest of [illegible] for [illegible] months [illegible]

[illegible] A note dated May 27, 1879, payable in 3 months, for [illegible] with interest at [illegible] discounted May 27, 1879, at [illegible]

[illegible] A note dated Jan. [illegible] 1879, payable in [illegible] months, for $10[illegible]2, with interest at [illegible] discounted Mar. 5, 1879, at [illegible]

[illegible] A note dated Oct. [illegible] 1878, payable in [illegible] months, for [illegible] with interest at [illegible] discounted Jan. 10, 1879, at [illegible]

[illegible] For what amount must a note be given [illegible] discounted at [illegible]?

[illegible] note is as many times [illegible] greater [illegible] as many times [illegible]

The following approximate method is generally used by business men: *To the given proceeds, add the interest for the given time.*

The interest of $1000 for 63 days is $10.50. $1000 + $10.50 = $1010.50. Since the interest is reckoned on the proceeds instead of the face of the note, the error, 11 cents, is equivalent to the interest of the interest ($10.50) for the given time.

Where greater accuracy is required, the necessary correction may be made. The interest of $10.50 for 63 days is 11 cents. $1010.50 + $.11 = $1010.61.

30. A owes B $1500; how large a 90-day note must A give B that when discounted at a bank at 6%, the proceeds will be sufficient to pay the debt?

31. I hold a note of $3000 against Mr. C., which he pays by giving a new note at 90 days for $1500, and the balance, including the discount on the new note, in cash. Required the amount of cash paid.

32. A merchant having $8000 to pay, gets a note for $5000, that will mature in 40 days, discounted at a bank at 6%. How large a note must he draw, payable in 90 days, for discount at the same rate, that the proceeds of the two notes may enable him to meet his payment?

PARTIAL PAYMENTS.

361. Partial Payments are payments in part of a note, mortgage, or other debt, made at different times.

362. Indorsements are the acknowledgments of the payments, written on the back of the note, mortgage, etc., and stating the amount and date of the payment.

Special receipts are sometimes given for such payments.

UNITED STATES RULE.

363. Ex. How much would be due Sept. 1, 1882, on a note of $600, dated March 1, 1882, with interest at 6%? Suppose a payment of $100 be made Sept. 1, 1882, to pay the interest and part of the principal, how much would then be due? *Ans.* $518.

Ex. How much would be required to settle the above note Jan. 1, 1883, the balance of $518 remaining on interest at the same rate from Sept. 1, 1882? *Ans.* $528.36.

the amount due on the following note, Jan. 19,

BOSTON, MASS., *Aug. 1, 1881.*

ne year after date, I promise to pay JORDAN, MARSH & Co., rder, One Thousand Dollars, for value received, with interest late, at 6 per cent.

ALEXANDER H. RICE.

On this note are the following indorsements:

ived Apr. 21, 1882, $200. Received Aug. 1, 1883, $100.
ived Dec. 1, 1882, $25. Received July 7, 1884, $400.

NOTE.—The method given in the following operation, is that adopted by the Supreme Court of the United States, and has been made the legal method of nearly all the States. By the United States Rule, as this is generally called, settlements are made whenever the payments are equal to or exceed the interest due; if the payment exceeds the interest, it is applied first to discharge the interest, and the surplus is applied towards paying the principal; if the payment is less than the interest, it is not applied until the nts, taken together, are sufficient to pay all interest due; since no interest is added to the principal to draw interest, a new principal can e greater than the preceding principal.

OPERATION.

f note, or principal, from Aug. 1, 1881		$1000
from Aug. 1, 1881, to Apr. 21, 1882 (8 *mo.* 20 *da.*), added		43.33
t, Apr. 21, 1882,		1043.33
ayment, Apr. 21, 1882,		200.00
new principal from Apr. 21, 1882		843.33
Interest of $843.33 from Apr. 21, 1882, to Dec. 1, 1882, (7 *mo.* 10 *da.*)	$30.92	
(Interest exceeds the payment, and a new principal is not formed.)		
Interest of $843.33 from Dec. 1, 1882, to Aug. 1, 1883, (8 *mo.*)	33.73	64.65*
[Payments $125 ($25 + $100), now greater than the interest due ($64.65)].		
Amount, Aug. 1, 1883,		907.98
Second and third payments, $25 + $100		125
New principal from Aug. 1, 1883		782.98

---

* In many cases it can be determined mentally in advance whether the payment is greater or less than the interest. In this case the interest could be taken at once from Apr. 21, 1882, to Aug. 1, 1883 (1 *yr.* 3 *mo.* 10 *da.*), since it is evident that the payment ($25) is less than the interest of $843.33 for 7 *mo.* 10 *da.* The interest of $800 for 7 *mo.* is $4 × 7, or $28, and it would be more on $843.33 for 7 *mo.* 10 *da.* If it is doubtful whether the payment is greater or less than the interest, perform all the work.

New principal from Aug. 1, 1883	$782.98
Interest of $782.98 from Aug. 1, 1883, to July 7, 1884 (11 *mo.* 6 *da.*)	43.85
Amount, July 7, 1884,	826.83
Fourth payment, July 7, 1884,	400
New principal from July 7, 1884	426.83
Interest of $426.83 from July 7, 1884, to Jan. 19, 1885 (6 *mo.* 12 *da.*)	13.66
Amount due Jan. 19, 1885, the final day of settlement, *Ans.*	$440.49

364. UNITED STATES RULE.—*Find the amount of the given principal to the time when the payment or the sum of the payments exceeds the interest due; subtract from this amount the payment or the sum of the payments. Treat the remainder as a new principal, and proceed as before, to the time of settlement.*

EXAMPLES.

365. NOTES.—1. In the following examples, find the time by compound subtraction.

2. In the first five examples, all the payments exceed the interest.

$1680. TRENTON, N. J., *Oct. 9, 1880.*

1. On demand, I promise to pay COOPER, HEWITT & Co., or order, Sixteen Hundred Eighty Dollars. Value received.

JOHN A. ROEBLING.

On this note were indorsed the following payments :
Dec. 21, 1881, received $289.12. June 9, 1883, received $991.50.
How much was due Jan. 30, 1884 ?

2. On a note dated May 11, 1877, for $2000, are the following indorsements : — Aug. 6, 1879, $361 ; Feb. 11, 1880, $901.60; Nov. 2, 1882, $1000. What remained due Feb. 2, 1883, at 6%? At 5% ?

3. On a note dated July 11, 1878, for $2400, are the following indorsements : — Sept. 17, 1879, $200 ; Jan. 29, 1880, $400 ; Nov. 29, 1881, $1150. What is the amount due Jan. 11, 1882, the interest being at 6% ? At 7% ?

4. On a mortgage for $1700, dated May 28, 1880, there was paid Nov. 12, 1880, $80; Sept. 20, 1881, $314; Jan. 2, 1882, $50 ; Apr. 17, 1882, $160. What was due Dec. 12, 1882, at 6%? At 8%?

5. On a note dated May 30, 1879, for $1660, are the following indorsements: — Apr. 9, 1880, $314; Nov. 4, 1880, $160; Aug. 25, 1881, $575. What was due June 30, 1882, at 6%? At 8%?

6. What was the amount due Oct. 17, 1881, upon a note for $1000, dated New York, Mar. 2, 1880, and on which the following payments were indorsed: — June 2, 1880, $60; Dec. 15, 1880, $20; May 2, 1881, $32; June 2, 1881, $60?

7. A note for $3000, dated May 12, 1880, bore the following indorsements: — Jan. 2, 1881, $255; Mar. 15, 1881, $225; June 3, 1881, $120; Aug. 6, 1881, $300; Feb. 8, 1882, $30. What was due June 2, 1882, at 6%? At 10%?

8. A note for $4000, dated Mar. 9, 1874, was indorsed as follows: — Jan. 18, 1876, $300; June 4, 1876, $400; Dec. 9, 1876, $1800; Sept. 1, 1879, $2000. How much had to be paid Jan. 1, 1880, to take up the note, at 6%? At 7%?

9. A mortgage of $6000 is dated May 9, 1877, on which there were the following payments: — July 15, 1878, $500; Nov. 27, 1878, $1000; June 1, 1879, $100; May 9, 1880, $275; Sept. 27, 1880, $2000. What was due Nov. 9, 1880, the interest being at 6%? At 12%?

10. What remained due June 3, 1883, on a note dated June 21, 1880, for $3300 with interest at the legal rate in Illinois, the following payments having been made? Oct. 9, 1880, $90; Jan. 15, 1881, $60; Mar. 27, 1881, $100; Aug. 6, 1881, $60; Dec. 15, 1881, $500. What remained due at the legal rate in Nevada?

MERCANTILE RULES.

366. The following methods are frequently used by merchants in finding the balance due on a note where partial payments have been made. They are similar to the methods in general use for finding the balance due on an open account (451).

367. When the note runs for one year only, or less.

368. [illegible] *the principal from the time* [illegible] *and on each payment from* [illegible] *the time of settlement, and* [illegible] *payments, including interest, from* [illegible] *principal and interest.*

NOTES.—1. This rule is used by some merchants when the note runs more than one year, although it is greatly to the disadvantage of the creditor, or holder of the note.

2. In solving examples by this rule, the different methods for finding time and interest, given in Art. **299**, are used. The results of the following examples will be given for the first method (Compound Subtraction and 360 days to the year).

EXAMPLES.

369. *1.* According to the mercantile rule, find the balance due May 12, 1882, on a note for $2400, dated July 12, 1881, on which the following payments have been made: Dec. 16, 1881, $40; Jan. 2, 1882, $100; Mar. 15, 1882, $150.

OPERATION.

Face of note, or principal, July 12, 1881,		$2400.00
Interest on the same to May 12, 1882 (10 *mo.*)		120.00
Amount, May 12, 1882		2520.00
First payment, Dec. 16, 1881,	$40.00	
Interest on the same to May 12, 1882 (4 *mo.* 26 *da.*)	.97	
Second payment, Jan. 2, 1882,	100.00	
Interest on the same to May 12, 1882 (4 *mo.* 10 *da.*)	2.17	
Third payment, Mar. 15, 1882,	150.00	
Interest on the same to May 12, 1882 (1 *mo.* 27 *da.*)	1.42	294.56
Balance due May 12, 1882		$2225.44

2. On a note dated Jan. 13, 1882, for $1234, are the following indorsements: May 17, 1882, $234; June 16, 1882, $345; July 27, 1882, $123; Sept. 19, 1882, $135. What remained due Nov. 13, 1882, at 6%? At 7%?

3. A note for $1567, dated Jan. 14, 1881, bore the following indorsements: Mar. 11, 1881, $50; May 13, 1881, $245; June 19, 1881, $374; Aug. 30, 1881, $412; Sept. 28, 1881, $316.40. What was due Jan. 1, 1882, at 6%? At 5%?

4. On a note dated Aug. 17, 1881, for $3300, were the following indorsements:—Dec. 18, 1881, $320; Feb. 5, 1882, $425; Apr. 13, 1882, $550; June 29, 1882, $630; July 16, 1882, $375; Aug. 1, 1882, $500. What amount was due Aug. 17, 1882, at 6%? At 10%?

5. On a note dated Mar. 16, 1883, for $2468, are the following indorsements: July 11, 1883, $750; Aug. 4, 1883, $428; Sept. 21, 1883, $150; Nov. 12, 1883, $170; Dec. 18, 1883, $128; Jan. 16, 1884, $224; Feb. 13, 1884, $600. What is the amount due Mar. 6, 1884, at 6%? At 8%?

the note runs for more than one year.

371. Since it is the custom of merchants and bankers to balance their accounts annually, the following method is used by em in computing the balance due on a note when it runs more one year.

It is equivalent to finding the balance due yearly by the previous rule, and ing the balance as a new principal. The periodical settlements are made nually, semi-annually, or quarterly, depending upon the custom of the merchant or banker in balancing his accounts. Some merchants make the end of the business year, Jan. 1 or July 1, the periodical rest, or date of settlement for notes and accounts.

When payments are made yearly greater than the interest due, this rule is the same as the New Hampshire rule for notes "with interest annually."

372. Rule.—*Find the amount of the principal for one year; also of each payment made during the year from the time the payment was made to the end of the year (1 yr. from the date of the note). From the amount of the prin- l, subtract the sum of the payments, including interest. the remainder as a new principal, proceed thus for n entire year that follows, and for the interval between end of the last year and the final date of settlement.*

EXAMPLES.

373. *1.* By the above rule, find the balance due Jan. 19, 1885, at 6%, on a note for $2400 dated Aug. 1, 1881, on which the following payments have been made: — Apr. 21, 1882, $200; Dec. 1, 1882, $25; Aug. 1, 1883, $100; July 7, 1884, $400. (Time by Compound Subtraction.)

OPERATION.

Face of note, or principal, Aug. 1, 1881,		$2400.00
Interest on the same for 1 year,		144.00
Amount, Aug. 1, 1882,		2544.00
First payment, Apr. 21, 1882,	$200.00	
Interest on the same to Aug. 1, 1882 (3 *mo.* 10 *da.*)	3.33	203.33
Balance and new principal, Aug. 1, 1882,		2340.67
Interest on the same for 1 year,		140.44
Amount, Aug. 1, 1883,		2481.11

Amount, Aug. 1, 1883,		2481.11
Second payment, Dec. 1, 1882,	$25.00	
Interest on the same to Aug. 1, 1883 (8 *mo.*)	1.00	
Third payment, Aug. 1, 1883,	100.00	126.00
Balance and new principal, Aug. 1, 1883,		2355.11
Interest on the same for 1 year,		141.31
Amount, Aug. 1, 1884,		2496.42
Fourth payment, July 7, 1884,	$400.00	
Interest on the same to Aug. 1, 1884 (24 *da.*)	1.60	401.60
Balance and new principal, Aug. 1, 1884,		2094.82
Interest on the same to date of settlement, Jan. 19, 1885 (5 *mo.* 18 *da.*)		58.65
Balance due Jan. 19, 1885,		$2153.47

2–10. Solve Examples 2–10, Art. **365**, according to the mercantile rule.

CONNECTICUT RULE.

374. The following rule for computing interest on obligations, where one or more payments have been made, was established by the Superior Court of Connecticut, March, 1784. (Kirby's Reports, page 49.)

375. RULE.—*I. Compute the interest to the time of the first payment; if that be one year, or more, from the time the interest commenced, add it to the principal, and deduct the payment from the sum total. If there be after-payments made, compute the interest on the balance due to the next payment, and then deduct the payment as above; and in like manner from one payment to another, till all the payments are absorbed; provided the time between one payment and another be one year or more.*

II. But if any payment be made before one year's interest hath accrued, then compute the interest on the principal sum due on the obligation for one year, add it to the principal, and compute the interest on the sum paid, from the time it was paid, up to the end of the year; add it to the sum paid, and deduct that sum from the principal and interest added as above.

III. If any payment be made of a less sum than the interest arisen at the time of such payment, no interest is to be computed only on the principal sum for any period.

NOTES.—1. Should the last date of settlement be less than one year from the last date of settlement, compute the interest on the principal and the payments, if any, to the final date of settlement.

2. When the time between the payments is one year or more, and the payments exceed the interest due, the Connecticut Rule is the same as the U. S. Rule (364). When the time between the payments is less than one year, and the payment exceeds the interest due at its date, the settlement is made by the first Merchants' Rule (366).

EXAMPLES.

376. 1. According to the law of Connecticut, how much is due June 1, 1885, on a note dated Aug. 1, 1881, for $1000, the following payments having been made? Apr. 21, 1882, $100; Dec. 1, 1883, $300; July 1, 1884, $20; Sept. 1, 1884, $200; Mar. 1, 1885, $300.

OPERATION.

Face of note, or principal,		$1000.00
Interest on the same for 1 year,		60.00
Amount, Aug. 1, 1882,		1060.00
First payment, Apr. 21, 1882,	$100.00	
Interest on the same to Aug. 1, 1882 (3 *mo.* 10 *da.*)	1.67	101.67
Balance and new principal, Aug. 1, 1882,		958.33
Interest to date of next payment, Dec. 1, 1883 (1 *yr.* 4 *mo.*)		76.67
Amount, Dec. 1, 1883,		1035.00
Second payment, Dec. 1, 1883,		300.00
Balance and new principal, Dec. 1, 1883,		735.00
Interest on the same for 1 year,		44.10
Amount, Dec. 1, 1884,		779.10
Third payment, July 1, 1884 (less than interest due)	$20.00	
Fourth payment, Sept. 1, 1884,	200.00	
Interest on the same to Dec. 1, 1884 (3 *mo.*)	3.00	223.00
Balance and new principal, Dec. 1, 1884,		556.10
Interest to date of settlement, June 1, 1885 (6 *mo.*)		16.68
Amount, June 1, 1885,		572.78
Fifth payment, Mar. 1, 1885,	$300.00	
Interest on the same to June 1, 1885 (3 *mo.*)	4.50	304.50
Balance due at settlement, June 1, 1885,		268.28

NOTE.—Examples [illegible] of Art. **365**, according to the Connecticut Rule, [illegible] **286**.

NEW HAMPSHIRE RULE.*

377. According to the laws of New Hampshire, when payments are made upon a note, or other contract, by virtue of which interest is payable *annually* (**336**), they should be applied in the following order to the payment of—

1. Any simple interest that may have accrued upon the annual interest.

2. The annual interest. 3. The principal.

378. RULE.—*Find the interest due upon the principal and the annual interest at the annual rest (the time when the annual interest becomes due from year to year) next after the first payment. To the payment or payments made before this rest, add interest from the dates when they were made to the date of the rest, unless there is no interest due upon the principal, excepting that which is accruing during the year in which the payment or payments were made, and the payments together are less than the interest thus accruing, in which last case no interest is to be added to the payments. Deduct the payment or payments, with or without interest, as aforesaid, from the amount of principal, annual interest, and simple interest upon the annual interest due at the time of said rest, if such payment or payments equal or exceed the annual and simple interest then due; if less than such annual and simple interest, but greater than the simple interest due upon the annual interest, deduct the same from the sum of the annual and simple interest, and upon the balance of such annual interest find simple interest to the time when the next payment or payments are applied; if less than the simple interest due upon the annual interest, deduct the same from such simple interest and add the balance without interest to the other interest due at the time when the next payment or payments are applied.*

Proceed in like manner to the time of the first annual rest following the next payment, and to the end of the time required.

---

* **From Report of State Superintendent of Public Instruction (1877).**

[illegible]

[illegible] [illegible]

[illegible]

[illegible] 1, 18[illegible] [illegible]		[illegible]
[illegible] 1, 18[illegible] 2, [illegible]		[illegible]
[illegible] 1, 18[illegible]		120.0
[illegible]		[illegible]
		[illegible]
[illegible]	[illegible]	
[illegible] 1, 18[illegible]	[illegible]	111.0
[illegible]		[illegible]
[illegible] annual interest of $1[illegible], due Jan. 1, 1884		112.0
[illegible] [illegible] interest accruing [illegible] does not draw interest		50.0
Balance of fourth annual interest unpaid		68.00
Fifth annual interest of $1[illegible], due Jan. 1, 1885		112
Sixth annual interest of $1[illegible], due Jan. 1, 1886		112
Simple interest on unpaid balance of fourth annual int. for 2 yr.		7.44
Simple interest on fifth annual interest for 1 year		6.72
Balance of principal		1[illegible]
Amount due Jan. 1, 18[illegible]		2[illegible].[illegible]

Solve Examples [illegible] and 9, Art. **[illegible]**, according to the New Hampshire Rule, at the legal rate (**298**), supposing each note to contain the words "with interest annually."

VERMONT RULE.

[illegible]. The Vermont Rule for notes with interest is essentially the same as the United States Rule (**[illegible]**); and for notes "with interest annually" [illegible] the same as the New Hampshire Rule, except that [illegible] payments are made on account of interest accruing [illegible] draw interest from the date they were made [illegible] or not than the interest accruing during the year.

[illegible] the payment [illegible] $50, in the above example, [illegible] 1884, or [illegible] months. The unpaid balance of fourth annual interest would be $61.25 ($112 — $50.75).

RATIO AND PROPORTION.

DEFINITIONS.

381. Ratio is the relation of two numbers as expressed by the quotient of the first divided by the second. Thus the ratio of 6 to 3 is 6÷3, or 2.

1. There is no ratio between quantities of different kinds; as 6 *bu.* and 3 *ft.* But a ratio exists between quantities of the same kind though of different denominations; as 6 *ft.* and 8 *in.* To express the ratio in such cases, the quantities must first be reduced to the same denomination. Thus, the ratio of 6 *ft.* to 8 *in.* is 72 *in.* ÷ 8 *in.*, or 9.

2. The ratio between two numbers is denoted by placing a colon (the sign of division without the horizontal line) between them. Thus, the ratio of 6 to 3 is expressed 6 : 3.

382. The numbers whose ratio is expressed are the **terms** of the ratio. The two terms of a ratio form a **couplet**, the first of which is the **antecedent**, and the second, the **consequent.**

383. Proportion is an equality of ratios.

The ratio of 6 *yd.* to 3 *yd.* is 2, and the ratio of $24 to $12 is 2; hence from the two equal ratios the following proportion can be formed—6 *yd.* : 3 *yd.* = $24 : $12. This expression is read, "The ratio of 6 *yd.* to 3 *yd.* equals the ratio of $24 to $12." In place of the sign of equality (=), four dots (: :) are generally used; thus, 6 *yd.* : 3 *yd.* : : $24 : $12. The expression is also read, "6 *yd.* is to 3 *yd.* as $24 is to $12."

384. The first and fourth terms of a proportion are called the **extremes**; and the second and third, the **means.**

385. PRINCIPLES.—1. *The product of the means is equal to the product of the extremes.*

2. *A missing mean may be found by dividing the product of the extremes by the given mean.*

3. A missing extreme may be found by dividing the product of the means by the given extreme.

386. To solve examples by proportion.

Ex. If 24 hats cost $27, what will 32 hats cost?

ANALYSIS.—For convenience, make the fourth term the missing term, or the required answer. Since the third and fourth terms must be of the same denomination and the denomination of the answer will be dollars, take $27 as the third term. From the nature of the example, the answer will be more than $27, the third term, therefore make 32 hats the second term, and 24 hats the first term. The proportion will then be stated as follows: 24 hats : 32 hats :: $27 : x (Let x represent the unknown term). Multiplying 32 by 27, and dividing the product by 24, the fourth or missing term will be $36.

387. RULE.—*For convenience, take for the third term the number that may form a ratio with, or is of the same denomination as, the answer. If from the nature of the example, the answer is to be greater than the third term, make the greater of the two remaining terms (which must be of the same denomination) the second term; when not, make the smaller the second term. Then multiply the means (the second and third) together, and divide their product by the given extreme (the first term).*

NOTE.—After the example is stated, any factor of the given extreme may be cancelled with an equal factor of either of the means.

EXAMPLES.

388. Find the missing term (represented by x) in each of the following proportions (See Principles, Art. **385**):

1. 16 : x :: 24 : 18.
2. x : 27 :: 18 : 54.
3. 32 : [illegible] 135.
4. 24 [illegible] 32 [illegible] $27 [illegible]
5. $48 : $75 :: $32 : x.
6. $375 : $144 :: 625 *lb.* : x.
7. $1728 : $288 :: $666 : x.
8. 144 *yd.* : 175 *yd.* :: $18 : x.

9. If [illegible] of silk cost $28.50, what will 37 *yd.* cost?

10. If [illegible] of carpet 36 [illegible] wide will cover a floor, how many yards 27 [illegible] wide will be required to cover the same floor?

11. A [illegible] high casts a shadow 5½ ft. long: how long a shadow is cast by the steeple of a church which is 234 feet high?

12. If the freight of a long ton (**172,** 3) is 70 shillings, what is the freight of 16375 pounds?

13. The net assets of a bankrupt are $27675, and the liabilities $138375. How much must be paid to Mr. A, whom he owes $4800?

14. A building is insured in several companies for $28000. During a fire the building is damaged to the amount of $13500. What is the loss of company A, whose risk is $5000?

15. A invests in business $8450, and B $7200, and the gain or loss is divided according to the investments. What is each partner's share of gain, the total gain being $3474.30?

16. The U. S. gold dollar (**181, 183**) contains 23.22 (25.8 —$\frac{1}{10}$) grains of pure gold, and the standard silver dollar 371.25 (412.5—$\frac{1}{10}$) grains of pure silver. What is the relative value of pure gold to pure silver?

17. The assessed value of the property of a certain town is $325000, and the total tax is $10238. How much is the tax of Mr. A, whose property is valued at $5700?

18. A bankrupt whose assets were $43225, pays 44 cents on a dollar; what did his debts amount to?

19. A cask holds 45 English (**167**) gallons; how many American gallons will it hold?

20. A company with a capital of $250000 divides $8750 among its stockholders. How much will be received by a stockholder who owns 36 100-dollar shares?

21. If a long ton of coal is worth $4.25, what is the value of a short ton?

22. If a farm valued at $4500 is taxed $26.24, what should be the tax on property valued at $23500?

23. If a man can walk a mile in 10 minutes, in what time can he walk a kilometer?

24. A piece of land 40 rods long and 4 rods wide contains an acre; what is the breadth of a piece 32 rods long, that is equivalent to an acre?

25. A merchant gains $625 by selling $12000 worth of goods; what amount must he sell to gain $8000?

26. Find the value of 6 *T.* (2240 *lb.*) 7 *cwt.* 2 *qr.* 20 *lb.* of iron at 85*s.* per ton.

27. How many feet of boards will be required for a fence 764 feet long, if 888 feet of boards are required for 288 feet?

INSURANCE.

DEFINITIONS.

389. Insurance is a contract by which one party (The Insurer or Underwriter) engages for a stipulated consideration (The Premium) to make up a loss which another may sustain.

Insurance is effected on property against loss or damage by fire and water, and on lives of persons. (For Life Insurance, see Art. 524.)

Insurance is also effected against accidents to persons, the breakage of plate glass, the loss of live stock, and the dishonesty of employees.

390. An **Insurance Company** is a company or corporation which insures against loss or damage.

Insurance companies usually make a specialty of a certain kind of insurance, as Fire, Marine, Life, Accident, etc. Certain companies combine Fire and Marine Insurance, while some of the large English companies have Fire, Marine, and Life departments.

391. Insurance companies may be classified according to principles of organization as follows:—1, Stock; 2, Mutual; 3, Mixed, or Stock and Mutual.

Of the [illegible] Fire (120), Fire Marine (49), and Marine (13) insurance companies doing business in the State of New York in 1879, 155 were Stock, 2 Mixed Stock and Mutual, and [illegible] Mutual. Their net assets, Dec. 31, 1879, were $[illegible] [illegible] $6,397,419.44.

There are [illegible] county co-operative insurance companies.

392. A **Stock Insurance Company** is one in which the capital [illegible] stockholders. They alone share [illegible] losses.

The business of a stock company and also of a mixed company, is managed by directors chosen by the stockholders. No policyholder, unless a stockholder, has any voice in any way in the election of the officers, or in the management of its business.

393. A **Mutual Insurance Company** is one in which there are no stockholders, and the profits and losses are shared among those who are insured (the policyholders).

Non-participating policies, the holders of which do not share in the profits or losses, are issued by certain mutual and mixed companies.

394. A **Mixed Insurance Company** is one which is conducted upon a combination of the stock and mutual plan.

Usually in a mixed company, all profits above a limited dividend to the stockholders are divided among the participating policyholders.

395. The **Policy** is the written contract between the Insurance Company (the Insurer or Underwriter) and the Insured. It contains a description of the property insured, the amount of the insurance, and the conditions under which the policy is issued, etc.

396. The **Premium** is the amount paid for the insurance.

1. Premium rates are expressed by giving the cost in cents of $100 insurance. The rate is sometimes expressed as a certain per cent. of the amount of the risk. Thus, a rate of 75 cents per $100 is equivalent to ¾%.
2. The premium rates depend upon the nature of the risk, and the length of time for which the policy is issued.
3. A fee of $1, or $1.25, is sometimes charged for the policy in addition to the premium.

397. An **Insurance Agent** is a person who represents an insurance company or several companies, and acts for them in soliciting business, collecting premiums, adjusting losses, etc.

398. An **Insurance Broker** is a person who effects insurance, for negotiating which he receives a commission or brokerage from the company taking the risk.

Brokers are regarded as agents of the insured, and not of the insurance company.

399. The **Surplus** of an insurance company is the excess of the assets over the liabilities (including capital and unearned premium).

FIRE INSURANCE.

400. Fire Insurance refers to insurance against loss or damage by fire.

Fire policies are usually issued for periods of from 1 to 5 years. Certain companies issue policies for longer periods. Of the outstanding risks of the largest insurance company of New York, Dec. 31, 1879, about 50% were for 1 year or less, 2% for 2 years, 28% for 3 years, 4% for 4 years, and 16% for 5 years.

401. Adjustment of Losses.—In an ordinary fire insurance policy, a person who insures will be paid the extent of his loss up to the amount of his insurance: but in policies containing the "average clause," the payment is such proportion of the loss as the amount of the insurance bears to the total value of the property.

1. The following is the usual form of the "average clause" above referred to. "It is a condition of this insurance, that if the whole value of the above described property, contained in any or all of the above mentioned buildings and premises, shall exceed the whole amount of insurance thereon, then, in case of loss or damage by fire, this policy shall contribute to the payment of said loss or damage in the proportion only that the whole amount of insurance on said property shall bear to the whole value of said property, in all of said buildings, at the time said loss or damage may occur."

2. Under a policy containing the "average clause," a person who insures $5000 on property worth $10000, would receive only $2500 in case of an actual loss of $5000; $1500 in a loss of $3000; $4000 in a loss of $8000.

3. Insurance companies usually reserve the privilege of replacing or repairing the damaged premises.

402. A Floating Policy is one which covers property stored in several buildings or places. The name is applied more particularly to policies which cover goods whose location may be changed in process of manufacture or in the ordinary course of business. The "average clause" is a usual condition of policies of this class.

403. Short Rates are rates for a term less than a year.

[illegible] is cancelled at the request of the policyholder [illegible] short rates for the time the policy has [illegible] company, a ratable proportion [illegible] unexpired term of the policy.

MARINE INSURANCE.

404. Marine Insurance refers to insurance of vessels and their cargoes against the dangers of navigation.

1. Inland and Transit Insurance refer to insurance of merchandise while being transported from place to place either by rail or water routes, or both.

2. Policies on cargoes are issued for a certain voyage, or from port to port, and on vessels for a specified time or for a certain voyage.

3. The particular average clause is the clause which exempts the insurance company from the payment of any partial loss or particular average, unless it exceeds a certain per cent. of the value of the property. The particular average clause is sometimes applied to the value of each parcel or series of parcels, according to invoice numbers.

4. Insurance Certificates, showing that certain property has been insured, and stating the amount of the insurance and the name of the party abroad who is authorized to make the settlement, are issued by marine companies. They are negotiable, and are usually sent to the consignee of the merchandise to make the loss payable at the port of destination, and to otherwise facilitate the adjustment of the insurance in case of loss.

405. Adjustment of Losses.—In marine insurance, in case of loss or damage, the insurance company contributes such proportion of the loss as the amount of the insurance bears to the total value of the property.

1. The adjustment of marine policies in case of loss is on the same principle as the adjustment of fire policies containing the "average clause" (**401,** 1).

2. In the adjustment of marine losses, the pound sterling is usually estimated at $4.95.

406. An **Open Policy** is one upon which additional insurances may be entered at different times. It covers merchandise which may be shipped on "Vessel or Vessels" from "Ports and Places" to "Ports and Places," for amounts "as endorsed" and at rates "as agreed."

1. The date of the shipment, name of vessel, ports of shipment and destination, the amount of the insurance, rate, premium, and a description of the property are entered on the policy or in a pass-book, which is regarded as part of the policy. (See Ex. 29, Art. **407**.)

2. Open policies with pass-books attached and insuring merchandise against loss or damage by fire, are issued by fire insurance companies.

3. Open policies, which cover all risks whether accepted and endorsed on the policy or not, are issued to merchants who are receiving merchandise from foreign countries, and who do not always have a definite knowledge of the time and mode of shipment. Such policies usually contain the following clause: "The company are to be entitled to premiums at their usual rates on all shipments reported or not. It is warranted by the assured to report every shipment on the day of receiving advice thereof, or as soon thereafter as practicable, when the rate of premium shall be fixed by the President or Vice-President of the Company."

The above policies cover the invoice cost and 10% additional until the amount of the risk is endorsed on the policy or pass-book.

4. Open policies are sometimes issued which cover only such risks as may be accepted and endorsed on the policy by the company.

EXAMPLES.

407. *1.* A building was insured for $2500 in one company at 1¼%, and for $5000 in another company at 125 cents. What was the total premium paid?

2. A cargo of goods was insured for $9000 at ¾%. What was the cost of the insurance, $1.25 being charged for the policy?

3. What is the total premium of the following insurances: $5000 at 1⅛% for 2 years, $7000 at 45¢ for 5 years, $1500 at 1% for 4 years, $2000 at 5% for 7 years, $3500 at 45¢ for 1 year, $2000 at 70¢ for 4 years, $4000 at 1¼% for 5 years, $2000 at 60¢ for 4 years, $4500 at 25¢ for 2 years, $3600 at 125¢ for 1 year, and $3000 at 240¢ for 4 years?

4. $20 were paid for an insurance of $2500; what was the premium rate?

5. $25.20 were paid for an insurance at the rate of 70¢ per $100. What was the amount of the risk?

6. A factory was insured for $7500 for 1 year at 2⅛%, stock for $2500 at 2½%, and raw material for $2500 at 1¼%. What was the total premium?

7. What is the cost of insuring a house for $5000 at the rate of 45¢ per $100?

8. A cargo of merchandise was insured for $6500 at ⅞%, including the risk of fire while on wharf awaiting shipment. What was the premium?

9. A building was insured Jan. 1, 1880, for $2000, for 7 years, at 5%; what was the value of the unearned premium, Jan. 1, 1882?

10. A shipment of goods was insured in the Pacific Mutual Insurance Co. for $9600 at 75¢ less 20% in lieu of scrip and interest. What was the net cost of the insurance?

11. A house was insured for $5000 for 4 years at 60¢ per annum. The house was destroyed by fire. What was the actual loss of the company, making no allowance for interest?

12. Suppose the above house was worth $8000. What was the actual loss of the owners?

13. A cargo of hides from Montevideo to New York having increased in value since the insurance was effected, the anticipated profits were insured for $3000 at 1¾% less 20%. What was the premium?

14. A factory (worth $3000) and its contents are insured for $10000 as follows: $2000 on building, $3000 on machinery (worth $5000), and $5000 on stock (worth $8000). The building is damaged by fire to the amount of $1000, the machinery $4000, and stock is a total loss. How much is the claim against the insurance company?

15. A cargo of goods valued at $20000 was insured for $12000. If the goods were damaged to the amount of $15000, how much of the loss would be paid by the insurance company? (Art. **405**.)

16. A building is insured in several companies for $60000, and is damaged by fire to the extent of $24000. What per cent. of its risk is paid by each company?

17. A stock of goods was insured, May 1, for 1 year, for $6000, at 90¢. The policy was cancelled Nov. 1, at the request of the insured. How much was the return premium, the short rate for 6 months being 63¢? How much would have been returned by the company, if the policy had been cancelled at its request?

18. A quantity of merchandise valued at $6000 is insured for $5000. It is damaged by fire to the amount of $1728. How much of the loss is paid by the insurance company, the policy containing the "average clause" (**401**)?

19. What was paid for insuring a cargo of merchandise for $8750 at ⅞% less 20%?

20. A marine rate of ½% for a voyage of 10 days is equivalent to what rate per annum?

21. What were the average net assets for every $100 insured of the F. F.-M., and M. Ins. Cos., doing business in the State of New York in 1879? (See Art. **391**, Note.)

A factory and its contents are insured for $5000 in comy $5000 in N, $5000 in O, $4000 in P, and $2500 in each he following companies: Q, R, S, T, U, V, W, X, Y, and Z. t was the total premium, the rate being 2% less 10%?

23. The above insurance covered the following property: 0 on building marked A on plan, $4000 on B, $5000 on C, on D, $500 on E, $3500 on stock and materials in building ked A on plan, $8000 on machinery, etc., in A, $11500 on ock and materials in B and C, $4000 on machinery, etc., in B nd C, $2500 on horses in D, $500 on harness, hay, feed, etc., D. Suppose building A and its contents were totally destroyed y fire, what would be the loss of company M? Of P? Of T?

NOTE.—The above insurance was divided pro rata among the several nies, each policy designating the exact amount on each building, etc.

4. In the above example, what is the amount of the risk of mpany M on the building marked A on plan? On C?

25. The net invoice value of a quantity of goods is $6325, and the insured value $6500. The insured value is what per cent. ater than the invoice value?

26. A quantity of merchandise valued at $9035, is insured for What is the insurance on part of the same, the estimated alue being $2638?

27. If 500 packages of merchandise are insured for $2627.78, what is the insurance on 60 packages?

28. The estimated sound value of a quantity of merchandise, aged at sea, was $328.55, and the proceeds when sold at auc- $299.35. How much of the loss was shared by the Insurance , the insurance having been $315.33?

29. Make the extensions of the following "open policy" and find the total amount.

Date.		Name of vessel.	From.	To.	On.		Amount insured.	Rate.	Amount of premium.
1881.									
Sept.	3	Othello	N. Y. via Hull.	Stockholm.	50	Bs. Mdse.	5100	1¼	**.**
"	7	Algeria	New York.	Liverpool.	68	" "	6675	½	**.**
"	10	Germanic	New York.	Liverpool.	92	" "	13500	½	**.**
"	17	Rialto	N. Y. via Hull.	Christiania.	6	" "	600	1	*.
"	30	Otranto	N. Y. via Hull.	Orebro.	30	" "	2700	1⅕	**.**
									$***.**
								Less 20%	**.**
									***.**

30. Claim of Shultz, Southwick & Co., for partial loss on merchandise, per "Lessing," from New York to Hamburg, Feb. 24, 1882.

Insured value of cargo $10000
Net invoice value 9696
Advance . . . . *** = *.*** %.

Marks and Numbers.	No. of pkgs. shipped.	Invoice weight	Invoice value.	No. of pkgs. damaged.	Proportional invoice weight.	Proportional invoice value.	Advance at *.***%.	Insured value of damaged.	Sound wt., Germ. lbs.†
H R 251	550	9497	28½¢	233	4023	1146.55			3621
2	150	3357	28½	46	1029	293.26			927
3	275	4702	27½	118	2018	554.95			1817
*	*	*	*	*	*	*			*
	2001			1071		$5137.03	$***.**	$****.**	16792

Sound weight 16792 *lbs.*—223 *lbs.* (Tare)=***** *lbs.* @ 1.35 Rm.=Rm. *****.**
Less discount 1% . . . . . ***.**
Sound value, . . . Rm. *****.**
Gross proceeds at auction . 14729.81
Loss . . . . Rm. ****.**

Loss = **.**% of sound value.

Insured value of damaged $****.** @ **.**% = loss $****.**
Charges, . . . Rm. 201.32
Inspection 185.44
Agents' fees, . . . 223 Rm. ***.** @ 24¢ = $***.**
Total claim . . . . $****.**

31. The total paid-up capital of the joint-stock fire and fire-marine companies doing business in the State of New York (excepting foreign companies), Dec. 31, 1879, was $50,992,220, and the surplus $34,998,146. The total surplus was what per cent. of the total capital?

32. The above companies, with the exception of the New York Mutuals (6), during the year 1879, received $69,657,129 in gross premiums for insuring $7,991,450,000. What was the average premium for every $100 insured?

33. Dec. 31, 1879, the capital stock of the Insurance Co. of N. A., Philadelphia, Pa., was $2,000,000; surplus, $2,338,378; dividend paid during 1879, $400,000. The surplus is what per cent. of the capital stock? The dividend is what per cent. of the capital, and of the capital and surplus?

---

† See Art. 243.

EXCHANGE.

DEFINITIONS.

408. Exchange is the system by which merchants in distant places discharge their debts to each other without the transmission of money.

Suppose, for example, A of New York owes B of Chicago $1000 for grain, and C of Chicago owes D of New York $1000 for dry goods. The two debts may be discharged by means of one draft or bill of exchange without the transmission of money. Thus, B of Chicago draws on A of New York for $1000, and sells the draft to C of Chicago who remits it to D of New York. D of New York presents the draft to A of New York for acceptance or payment, and thus both debts are cancelled. There is in effect a setting-off or exchange of one debt for the other.

The business of exchange is usually conducted through the medium of banks and bankers, who buy commercial bills and transmit them for credit to the places on which they are drawn. They also sell their own drafts on their correspondents in any amounts demanded.

409. A **Bill of Exchange,** or **Draft,** is an order or request addressed by one person (the Drawer) to another (the Drawee), directing the payment of a specified sum of money to a third person (the Payee) or to his order. It is issued at one place and payable at another. (See Art. **352**, 5–6.)

For brevity, bills of exchange are frequently called "exchange."

According to the laws of most States, drafts drawn in one State and payable in another, are termed *foreign* bills of exchange. For the purposes of this book, the term "domestic exchange" will be applied to bills drawn and payable in the United States.

410. Bills of exchange are of two kinds, Inland or Domestic, and Foreign.

411. A **Domestic** or **Inland Bill of Exchange** is one which is payable in the same country in which it is drawn.

412. **A Foreign Bill of Exchange** is one which is payable in a different country from the one in which it is drawn; as a draft drawn in the United States and payable in England.

413. When drafts sell for more than their face value, exchange is above par or at a premium; when for less than their face, below par or at a discount.

When Chicago owes New York the same amount that New York owes Chicago, exchange will be at par; that is, drafts will sell at their face value. When Chicago owes New York more than New York owes Chicago, drafts on New York will sell at a premium; there will be more buyers of exchange than sellers, and drafts will sell for more than their face value. When Chicago owes New York less than New York owes Chicago, the demand in Chicago for drafts on New York will be less than the supply, and drafts will sell for less than their face value, or at a discount.

DOMESTIC EXCHANGE.

414. **Domestic** or **Inland Exchange** relates to drafts drawn at one place on another in the same country.

415. The domestic exchanges on New York at the places named were quoted as follows, May 7, 1881: Savannah, $\frac{1}{8}$ @ $\frac{3}{8}$ premium; Charleston, $\frac{1}{8}$ @ $\frac{1}{4}$ premium; New Orleans, $1.50 @ $2.50 premium; St. Louis, 25 cents premium; Chicago, 50 @ 75 cents premium; and Boston, 25 cents discount.

1. At Savannah and Charleston the rates per cent. of the premium or discount are given. Thus, when exchange is quoted at $\frac{1}{4}$ premium, a draft of $100 may be purchased for 100\frac{1}{4}$ ($100.25).

2. At New Orleans, St. Louis, Chicago, and Boston, the premium or discount per $1000 is given. Thus, a draft of $1000 at $2.50 premium may be purchased for $1002.50. $2.50 per $1000 premium is equivalent to $\frac{1}{4}$% premium.

3. The selling rates are about $\frac{1}{8}$% ($1.25) higher than the buying rates, and bankers' exchange is usually higher than commercial.

4. The rate of domestic exchange is limited by the cost of shipping gold or currency by express, and the premium or discount will not exceed this cost. Thus, if a merchant in Chicago is charged a premium of $10 for a draft of $10000, and he can send the currency by express for $7.50, it will be to his advantage to remit by the latter method.

The following appeared in a New York financial paper, May 8, 1881, the date of the above quotations: — "The domestic exchanges at the West are sufficiently high to permit of a movement of funds Eastward, but at the East, [illegible] of gold and [illegible]

[illegible] These drafts are dis- [illegible] cases bankers [illegible] interest for the [illegible] draft is paid, and [illegible] days after sight, bankers [illegible] the acceptance of the [illegible] and payable [illegible] ordinary course of the mails, [illegible] draft would be paid in 63 days [illegible] days would elapse before the money [illegible] banker would be justified in charging [illegible] they advanced the money in [illegible] If the draft was drawn [illegible] the acceptance, 3 days of grace, [illegible] money would be added [illegible] time of the [illegible] other distant places, money [illegible]

[illegible]

[illegible] Savannah, of a draft on New [illegible]

[illegible] New York for [illegible]

[illegible]	Exchange.
[illegible]	15 discount.
[illegible]	25 premium.
[illegible]	1.25 discount.
[illegible]	2.50 premium.
[illegible]	75 discount.

[illegible] New York to the [illegible] drawn on B, [illegible] proceeds would [illegible]

[illegible] value of the [illegible] business [illegible] the draft, [illegible] the above [illegible] which added [illegible] and produces [illegible] percentage of [illegible] cent.

For ordinary examples in business, the foregoing method is sufficiently accurate. At ½%, or $5.00 (a very high rate for domestic exchange) on a draft whose value is $10000, the error would be only 25 cents. If greater accuracy is required, the necessary correction can be made by adding the percentage of the premium or discount. Thus, if the value of the draft is $10000, and exchange is ½% discount, the face would be $10000 + $50 (½% of $10000) + $0.25 (½% of $50) = $10050.25. If at ½% premium, the face would be $10000 − $50 + $0.25 = $9950.25.

By the above method, find the face of the following drafts:

	Value.	Exchange.		Value.	Exchange.
14.	$1876.16,	¼% premium.	*19.*	$7375,	25¢ premium.
15.	$2437.75,	¼% discount.	*20.*	$9218,	50¢ discount.
16.	$3342.38,	⅛% discount.	*21.*	$6438,	$1.00 premium.
17.	$2238.42,	½% premium.	*22.*	$9243,	$1.25 premium.
18.	$8175.50,	⅜% premium.	*23.*	$5280.	75¢ discount.

24. A of New Orleans being indebted to B of New York $9316.75, forwards to him a check on a New Orleans bank for that amount, to cash which B is obliged to allow a discount of ¼%. How much does A still owe B, and for what amount should the check have been drawn to net B the amount due?

25. What is the value of a draft on New York for $3000, payable in 60 days (63 days) after date (**353**, 8), exchange being ⅛% premium, and interest 6%?

NOTE.—From the face of the draft, subtract the interest, and to the result add the exchange.

26. Find the proceeds of a draft drawn at Chicago on New York for $12000, and payable 90 days after sight, exchange 50¢ discount, interest 5%, and allowing 3 days additional for the acceptance of the draft.

27. A banker in New York discounts a draft for $8000, payable in San Francisco 60 days after sight; what would be the proceeds, exchange being ½% discount, interest 6%, and allowing 8 days for the acceptance and 8 days for the return of the money?

28. A merchant paid $6920.64 in Charleston for a sight draft of $6912; what was the rate of exchange?

29. A commission merchant sold 13475 pounds of leather at 26¾ cents a pound. If his commission is 5%, and exchange ⅛% premium, how large a draft can he buy to remit to the consignor?

30. How large a 60-days' draft must I draw, so that when sold it will produce $10000, exchange ⅛% discount, interest 6%?

FOREIGN EXCHANGE.

1. [illegible] relates to drafts or bills of exchange [illegible] another.

[illegible] in the moneys of account of [illegible] Thus, drafts on England are usually [illegible] Belgium and Switzerland, [illegible] (Holland) in guilders. [illegible] sight, 60 days or at [illegible] are frequently called "short" [illegible] "long" exchange is sold [illegible] to equalize the difference [illegible] of bills.

2. [illegible] transmission of foreign [illegible] two or three of the [illegible] sent by different [illegible] others become [illegible] second, and pre- [illegible]

[illegible] EXCHANGE.

[illegible]

[illegible] New York, Dec. 10, 1882.

[illegible] of Exchange (Second and [illegible] & Co., One [illegible] charge the same [illegible]

[illegible] Brothers & Co.

[illegible]

(3.)

EXCHANGE FOR £1000. NEW YORK, *May 16, 1882.*

Sixty days after sight of this THIRD of Exchange (First and Second unpaid), pay to the order of A. T. STEWART & Co., One Thousand Pounds Sterling, value received, and charge the same to account of

No. 1738. BROWN BROTHERS & CO.

To BROWN, SHIPLEY & Co.,
London, England.

419. A Letter of Credit is an instrument issued by a banker and addressed to bankers generally, by which the holder may draw funds at different places and in amounts to suit his convenience, the total amount drawn not exceeding the limit of the letter of credit.

A *bill of exchange* is payable at a certain place, at a certain fixed time, and for a certain amount, while a *letter of credit* is payable at different places, at different times, and in different amounts.

A person, who intends to travel in foreign countries, may procure a letter of credit by depositing either cash or securities with a foreign exchange banker for the amount of the letter. When the American banker is notified of the payment of the traveler's drafts in London, he debits the account of the holder of the letter of credit with the amount drawn and the charges, at the current rate of exchange. A small rate of interest is allowed on the account, and a settlement is made on the return of the traveler.

If a person has business connections, he may avoid making a deposit by having some commercial firm sign a bond as security. By this method, when the New York banker is notified of the payment of the traveler's draft in London, he immediately draws a sight draft (**420**) for the amount and the charges (**420**) on the traveler's representative, and no account is kept with the traveler on the books of the banker. In this case, a settlement is made with the commercial house on the return of the traveler.

The holder of a letter of credit desiring funds, presents it to a banker at the place he may be visiting. The banker will prepare a sight draft, which the holder of the letter will sign, on the London banker mentioned in the letter of credit. If the signature on the draft and on the letter of credit correspond, the draft will be cashed by the banker at the current rate of exchange. The bankers who cash the drafts of the holder of the letter, write the date of payment, their names, and the amounts drawn (in words and figures), on the back of the letter of credit. When the London banker pays the drafts, he immediately notifies the American banker (the issuer of the letter of credit). The foreign bankers mentioned as correspondents in a Letter of Credit are bound to honor the drafts of the holder; but other banks and agencies where the parties are known, are also free to respond.

BROWN BROTHERS & CO.'S CIRCULAR LETTER OF CREDIT.

No. $\frac{B}{B}$ 14506.

NEW YORK, *June 2, 1881.*

GENTLEMEN:—We request that you will have the goodness to furnish MR. EUGENE HORTON, the bearer, whose signature is at foot, with any funds he may require to the extent of £1000 (say One Thousand Pounds Sterling), against his drafts upon MESSRS. BROWN, SHIPLEY & Co., London; each draft *must bear the number* (No. $\frac{B}{B}$ 14506) of this letter, and we engage that the same shall meet due honor.

Whatever sums MR. HORTON may take up, you will *please endorse on the back* of this Circular letter, which is to continue in force till June 2, 1882, from the present date, June 2, 1881.

We are respectfully, gentlemen,
Your obedient humble servants,
BROWN BROTHERS & CO.
The Signature of
EUGENE HORTON.

To MESSRS. THE BANKERS,
Mentioned on the third page of this Letter of Credit.

420. The following draft, drawn by the issuer of the letter of credit on the traveler's American representatives, shows the expense connected therewith:

		£.	s.	d.
No. 51931.	Draft dated Lucerne, July 20.	25		
	Commission @ 1%, ...		5	
Cr. $\frac{B}{B}$ 14506.	Interest for 33 days @ 5%, .		2	3
		25	7	3

NEW YORK, *Aug. 11, 1881.*

EXCHANGE FOR £25 *7s. 3d.*, at $\$4^{\underline{85}}$ per £ = $\$122^{\underline{25}}$.

On demand, pay this FIRST of Exchange (Second unpaid), to our order, the sum of Twenty-five Pounds $^7/_3$ Sterling, for value received by MR. EUGENE HORTON.

BROWN BROTHERS & CO.

To MESSRS. G. B. HORTON & CO., }
New York. }

NOTES.—1. The commission is charged only on amounts drawn and not on the face of the letter of credit.

2. The interest charged is calculated to cover the time between the payment of the original draft in London and the maturity of a shortsight remittance from New York in reimbursement.

3. Exchange is charged at the current rate of sight exchange on London.

421. The **Intrinsic Par of Exchange** is the value of the monetary unit of one country expressed in that of another, and is based on the comparative fineness and weight of the coins, as determined by assay.

The intrinsic par of exchange between different countries and the United States, is given in Art. **192.**

422. The **Commercial Par of Exchange** is the market value in one country of the *coins* of another.

423. The **Commercial Rate of Exchange** is the market or buying and selling value in one country of the *drafts* on another.

1. In giving quotations of foreign exchange, no reference is made to the par value, the quotations being given by means of equivalents.

2. Premium or discount for exchange can not long exceed the transportation charges and insurance of shipping coin; for, if a merchant can ship gold cheaper than he can buy a bill of exchange, he will choose the former method of paying his indebtedness. When sight exchange is 4.84, gold can be imported at a small profit; and when sight exchange is 4.89½, gold can be exported at a profit.

424. The quotations of foreign exchange, Apr. 20, 1881, were as follows:

Where payable.	60 days.	Sight.
London:		
Prime bankers'.	4.81½	4.84
Good bankers' and prime commercial.	4.81	4.83½
Documentary commercial.	4.78½	4.81½
Cable transfers.... 4.84½		
Paris (francs).	5.27½	5.24⅜
Antwerp (francs).	5.27½	5.24⅜
Swiss (francs).	5.26⅞	5.23⅛
Amsterdam (guilders).	.39⅝	.39⅞
Hamburg (reichsmarks).	.93⅜	.94⅜
Frankfort (reichsmarks).	.93⅜	.94⅜
Bremen (reichsmarks).	.93⅜	.94⅜
Berlin (reichsmarks).	.93⅜	.94⅜

[illegible] preceding quotations exchange is below par. See intrinsic par [illegible] 1921 [illegible] exchange is above par. We are [illegible] we are importers of gold.

195. [illegible] England (Sterling exchange) is quoted by [illegible] value of £1 in dollars and cents.

[illegible] a draft of £1 will cost $4.84; [illegible] £100, $484. [illegible] of £1 is $4.8665 (1921).

196. Exchange [illegible] France, Belgium, and Switzerland is [illegible] francs and centimes (hun- [illegible] franc).

[illegible] francs and [illegible] $9.57 [illegible] The [illegible] cents (1922) [illegible] exchange.

[illegible] exchange [illegible] apparent [illegible] exchange [illegible] 100 [illegible] The exchange [illegible]

197. Exchange [illegible] Amsterdam, Netherlands, is quoted by [illegible] cents.

[illegible] 1922.

198. [illegible] value of [illegible]

[illegible] marks [illegible] 1922 [illegible] 4 marks

199. [illegible] exchange [illegible] a shipper [illegible] accompanied by [illegible] insurance certificates.

[illegible]

200. [illegible] and [illegible]

[illegible] cents

[illegible] centimes

[illegible]

[illegible]

[illegible] cents

[illegible] cents

EXAMPLES.

431. *1.* Find the cost of a bill of exchange on London for £225 at 4.81¾.

Analysis.—If £1 costs $4.81¾, £225 will cost 225 times $4.81¾.

2. What is the value of a draft for £324 16*s.* at 4.87½?

Note.—Write one-half of the greatest even number of shillings as tenths of a pound, and if there be an odd shilling write 5 hundredths. Thus, £324 16*s.* = £324.8; £324 17*s.* = £324.85. (See Art. **204**, Ex. 7, Note.) The value of £324 16*s.* at 4.87½ is found by multiplying $4.87½ by 324.8.

3. Find the value of a draft on London for £379 12*s.* 7*d.*, at 4.86⅜.

```
OPERATION.
  379.6
  4.86⅜
 ------
    949
    475
  22776
 182208
     14
 ------
1846.420
```

Analysis.—If each penny be regarded as 2 cents, the result will be sufficiently accurate. For 11*d.* the maximum number of pence in any example, and exchange at 4 91, the error would be only ½ cent. $4.86⅜ × 379.6 = $1846.28. $1846.28 + $0.14 = $1846.42. To save one addition, add the 14 cents to the partial products as in the operation.

Find the value of

4. £500 at 4.81½.

5. £775 at 4.85¼.

6. £837 at 4.83⅞.

7. £84 8*s.* at 4.85.

8. £512 13*s.* at 4.84⅜.

9. £834 6*s.* 6*d.* at 4.88⅝.

10. £675 11*s.* 8*d.* at 4.87⅛.

11. £225 7*s.* 5*d.* at 4.82¾.

12. Find the cost of a bill of exchange on Liverpool, for £875 12*s.* 6*d.* at the par value.

13. What are the proceeds of a draft of £959 5*s.* 4*d.*, sold through a broker, at 4.79½, brokerage ⅛%?

14. An expòrter sold a draft for £540 3*s.* on Manchester, payable in Londòn, at 4.84,brokerage ⅛%. What were the proceeds?

15. Find the proceeds of a draft on Newcastle-on-Tyne, at 60 days' sight for £1764 15*s.*, payable in London, at 4.82, brokerage on exchange ⅛%.

16. An importer purchased a bill of exchange on London, at 3 days' sight, for £488 16*s.* 6*d.*, at 4.85¼. What was the cost?

17. How much exchange on London at 4.81¾ will $821.99 buy?

Analysis.—$4.81¾ will buy exchange for £1; hence, $821.99 will buy as many pounds as $4.81¾ are contained in $821.99, or £170.625. £170.625 = £170 12*s.* 6*d.*

18. What will be the face of a 3 days' bill of exchange on London that can be bought for $5964.13, exchange 4.86¼?

19. The face of a bill of exchange was £875, and its cost was $4233.91. What was the rate of exchange?

20. An exporter received $9063.22 for a bill of exchange that was sold through a banker at $4.86¾; what was the face of the bill, the broker's commission being ⅛%?

21. Find the cost of a bill of exchange on Paris for 7000 francs at 5.21⅞.

Operation.

$$\begin{array}{r|l} 5.21\tfrac{7}{8}\,) & 7000 \\ 8 & 8 \\ \hline 41.75\ \ ) & 56000.0000\ (\end{array}$$

Analysis.—Since 5.21⅞ francs cost $1, 7000 francs will cost as many dollars as 5.21⅞ francs are contained times in 7000 francs.

Find the value of

22. 6000 francs at 5.16.
23. 5000 francs at 5.18⅛.
24. 4000 francs at 5.21⅜.
25. 8475 francs at 5.19½.
26. 7216 francs at 5.17¾.
27. 987.60 francs at 5.20⅞.

28. Find the cost of a draft on Antwerp at 3 days' sight, for 9640 francs, at 5.19⅜.

29. What is the value of a draft on London for £416 16*s.* 3*d.*, at 4.85⅜?

30. Bought exchange on Geneva, through a broker, for 8000 francs at 60 days' sight; what was the cost of the draft, exchange being 5.20⅝, brokerage ⅛%?

31. What is the cost of a draft on Paris for 12420 francs, at 5.19¾, brokerage on exchange ⅛%?

32. What will it cost to remit to Antwerp 8750 francs at the par value?

33. Sold through a broker a draft on Geneva for 7324 francs. What were the proceeds, exchange being 5.18⅜, brokerage ⅛%?

34. What will be the face of a bill of exchange on Geneva that can be bought for $15372, exchange selling at 5.22½?

35. Paid for a draft on Paris $3460.32; what was the face of the draft, exchange being 5.19⅜, and brokerage ⅛%?

36. A merchant paid $6272 for a bill of exchange of 32512.48 francs ; what was the rate of exchange ?

37. Find the cost of a bill of exchange on Hamburg for 14400 marks (Reichsmarks) at 94⅛.

OPERATION.

$$\begin{array}{r} 4\,)\,\underline{14400} \\ 3600 \\ \underline{.94\tfrac{1}{8}} \\ 3388.50 \end{array}$$

Analysis.—Since 4 marks cost $0.94⅛, 14400 marks will cost 3600 (14400 ÷ 4) times $0.94⅛, or $3388.50.

Find the value of

38. 7200 marks at 94.
39. 8416 marks at 93⅛.
40. 3456 marks at 95¼.
41. 1237 marks at 93⅝.
42. 9894 marks at 95⅜.
43. 6515 marks at 94¾.

44. What is the cost of a bill of exchange on Frankfort for 16200 marks at 95½ ?

45. Sold a bill of exchange on Hamburg for 13200 marks, at 94⅛ ; what was the amount received, brokerage ⅛% ?

46. An importer purchased a bill of exchange on London for £318 10*s.* 7*d.*, at 4.85¾ ; what did it cost ?

47. What were the proceeds of a draft, sold through a broker, for 8748 marks, at 94⅜, brokerage ⅛% ?

48. An exporter sold a draft on Paris for 12275 francs, at 5.19⅝ ; what were the proceeds, brokerage ⅛% ?

49. What is the face of a bill on Hamburg that cost $816, exchange 94⅛ ?

Analysis.—Since $.94⅛ will buy 4 marks, $816 will buy 4 times as many marks as $0.94⅛ is contained times in $816.

50. What is the face of a 3 days' draft on Bremen, that was purchased in New York for $3261.60, exchange 94⅜ ?

51. The cost of a draft of 12320 marks was $2922.15 ; what was the rate of exchange ?

52. Find the cost of a bill of exchange on Amsterdam, for 7240 guilders, at 40⅛.

53. Find the cost of a bill of exchange on Amsterdam, at 60 days' sight, for 12480 guilders, exchange 39⅞, brokerage ⅛%.

54. An exporter received $1890.86 for a bill of exchange on Amsterdam; what was its face, exchange being 41⅛, brokerage ⅛% ?

17. How much exchange on London at 4.81¾ will $821.99 buy?

Analysis.—$4.81¾ will buy exchange for £1; hence, $821.99 will buy as many pounds as $4.81¾ are contained in $821.99, or £170.625. £170.625 = £170 12*s.* 6*d.*

18. What will be the face of a 3 days' bill of exchange on London that can be bought for $5964.13, exchange 4.86⅛?

19. The face of a bill of exchange was £875, and its cost was $4233.91. What was the rate of exchange?

20. An exporter received $9063.22 for a bill of exchange that was sold through a banker at $4.86¾; what was the face of the bill, the broker's commission being ⅛%?

21. Find the cost of a bill of exchange on Paris for 7000 francs at 5.21⅞.

OPERATION.

$$\begin{array}{r|l} 5.21\tfrac{7}{8}\,) & 7000 \\ 8 & 8 \\ \hline 41.75\ ) & 56000.0000\ (\end{array}$$

Analysis.—Since 5.21⅞ francs cost $1, 7000 francs will cost as many dollars as 5.21⅞ francs are contained times in 7000 francs.

Find the value of

22. 6000 francs at 5.16.

23. 5000 francs at 5.18⅛.

24. 4000 francs at 5.21⅜.

25. 8475 francs at 5.19½.

26. 7216 francs at 5.17¾.

27. 987.60 francs at 5.20⅞.

28. Find the cost of a draft on Antwerp at 3 days' sight, for 9640 francs, at 5.19⅜.

29. What is the value of a draft on London for £416 16*s.* 3*d.*, at 4.85⅜?

30. Bought exchange on Geneva, through a broker, for 8000 francs at 60 days' sight; what was the cost of the draft, exchange being 5.20⅝, brokerage ⅛%?

31. What is the cost of a draft on Paris for 12420 francs, at 5.19¾, brokerage on exchange ⅛%?

32. What will it cost to remit to Antwerp 8750 francs at the par value?

33. Sold through a broker a draft on Geneva for 7324 francs. What were the proceeds, exchange being 5.18⅜, brokerage ⅛%?

34. What will be the face of a bill of exchange on Geneva that can be bought for $15372, exchange selling at 5.22⅛?

35. Paid for a draft on Paris $3460.32; what was the face of the draft, exchange being 5.19⅜, and brokerage ⅛%?

36. A merchant paid $6272 for a bill of exchange of 32512.44 francs; what was the rate of exchange?

37. Find the cost of a bill of exchange on Hamburg for 14400 marks (Reichsmarks) at $94\frac{1}{8}$.

OPERATION.

4) 14400

3600

$.94\frac{1}{8}$

3388.50

ANALYSIS.—Since 4 marks cost $$0.94\frac{1}{8}$, 14400 marks will cost [illegible] (14400 ÷ 4) times $$0.94\frac{1}{8}$, or $3388.50.

Find the value of

38. [illegible] marks at [illegible].

39. [illegible] marks at [illegible].

40. 3456 marks at [illegible].

41. 123[illegible] marks at [illegible].

42. [illegible] marks at [illegible].

43. [illegible] marks at [illegible].

44. What is the cost of a bill of exchange on Frankfort for 16300 marks at [illegible]?

45. Sold a bill of exchange on Hamburg for 18800 marks, at [illegible]; what was the amount received, brokerage [illegible]%?

46. An importer purchased a bill of exchange on London for £318 14s. [illegible] at [illegible]; what did it cost?

47. What were the proceeds of a draft sold through a broker, for [illegible] marks, at [illegible], brokerage [illegible]%?

48. An exporter sold a draft on Paris for [illegible] francs, at [illegible]; what were the proceeds, brokerage [illegible]%?

49. What is the face of a bill on Hamburg that cost $816, exchange [illegible]?

ANALYSIS.—Since $[illegible] will buy 4 marks, $816 will buy 4 times as many marks as $[illegible] is contained times in $816.

50. What is the face of a 3 days' draft on Bremen, that was purchased in New York for $[illegible], exchange [illegible]?

51. The cost of a draft of [illegible] marks was $2922.15; what was the rate of exchange?

52. Find the cost of a bill of exchange on Amsterdam, for [illegible] guilders, at [illegible].

53. Find the cost of a bill of exchange on Amsterdam, at [illegible] days' sight, for [illegible] guilders, exchange [illegible], brokerage [illegible]%.

54. An exporter received $[illegible] for a bill of exchange on Amsterdam; what was its face, exchange being [illegible], brokerage [illegible]?

55. At 40⅛, how much exchange on Amsterdam will $2877.93 buy?

56. The value of a draft of 5280 guilders is $2145; what is the quotation?

57. The dividends of the N. Y. C. and H. R. R. Co., are paid in London at the rate of 49¼ pence to the dollar. What is the equivalent rate of exchange?

58. Find the value in U. S. money of 16819 bushels of wheat at [illegible] per bushel, exchange 4.86¼.

59. A merchant sent a messenger with a bill of exchange of [illegible] francs to two bankers, A and B, with instructions to sell it to the best advantage. A offered 5.27 and B 5.27[illegible]. The messenger ignorantly accepted the latter offer. How much did the merchant lose by the ignorance of the messenger?

60. When United States 4 per cent. consols are quoted in New York at [illegible], and sterling exchange at 4.83[illegible], what should be the London quotation of the bonds? What should be the London quotation of 4 per cent. bonds, the New York quotation being 113[illegible]?

Note.—In London all American securities are quoted at an assumed value of the pound sterling of $5, instead of the actual value of $4.8665, or [illegible] by the rate of exchange. [illegible] the New York quotation by 5 and dividing by the rate of exchange [illegible] the equivalent London quotation.

[illegible] American railroad stocks are quoted in London at [illegible] New York quotation, sterling exchange [illegible]?

[illegible] London equivalent of [illegible] New York quotation [illegible]

[illegible] of a draft on London of £550 [illegible]

[illegible] of a draft on Hamburg [illegible]

[illegible] of a draft on London [illegible] £65 [illegible]

[illegible] Lisbon [illegible]

[illegible]

EQUATION OF ACCOUNTS.

DEFINITIONS.

432. Equation of Accounts (called also Equation of Payments and Averaging Accounts) is the process of finding the time when several debts due at different dates may be paid in one amount without loss of interest to either party. It is also the process of finding the time when the balance of an account having both debits and credits may be paid without loss of interest to either party. This time is called the *equated* or *average time.*

433. To find the equated time when the items of the account are all on the same side, i. e., all debits or all credits.

ANALYTICAL STEPS.—By assuming a certain date as the time of settlement, we find what the loss or gain of interest would be to the payer if all the bills were paid by him on that date. We next find in how many days the total amount of the bills would produce a sum equivalent to this loss or gain of interest, and find the true day of settlement by counting forward or backward this number of days from the assumed date. Thus, if the sum of the several bills is $1000, and the loss of interest to the payer at the assumed date of settlement is $10 (the interest of $1000 at 60 days at 6%), it is evident that the true date of settlement, or the time when there would be no loss of interest to either party, must be 60 days after the assumed date.

NOTES.—1. The interest on the bills paid after they became due would equal the interest on the bills paid in advance, the former being a gain to the payer, and the latter, a loss.

2. Any date may be assumed as the time of settlement. For convenience, the earliest or latest date is generally used. If the earliest date is taken, the estimated interest is a loss to the payer; if the latest is taken, the interest is a gain.

e is found by Compound Subtraction, or each month is as 30 days, the last day of the month preceding the earliest item is ost convenient. (See second interest method.)

In Equation Tables, Dec. 31 or Jan. 1 is taken for all examples.

The assumed date is sometimes called the *focal date.*

Any rate of interest may be used in making the computations, 6 and g the most convenient rates.

Ex. At what date may the following bills of merchan- e paid in one amount without loss of interest to either y? Due Apr. 10, $114; due Apr. 26, $140; due May 22, 0; due June 6, $976.

OPERATION.—PRODUCT METHOD.

$$
\begin{array}{llrcrcr}
\text{Due} & \text{Apr. 10,} & \$114 & \times & 0 & = & 0 \\
\text{"} & \text{" 26,} & 140 & \times & 16 & = & 2240 \\
\text{"} & \text{May 22,} & 320 & \times & 42 & = & 13440 \\
\text{"} & \text{June 6,} & \underline{976} & \times & 57 & = & \underline{55632} \\
 & & 1550 & & & &)\ 71312\ (\ 46 \text{ days}
\end{array}
$$

after Apr. 10, or May 26.

ANALYSIS.—For convenience, assume Apr. 10, the earliest due date, as time of settlement. If the first bill, which is due Apr. 10, is paid on that there will be no loss or gain of interest to either party. If the second which is due Apr. 26, is paid Apr. 10, 16 days before it is due, there will a loss to the payer of the interest or the use of $140 for 16 days, or $2240 for day. On the third bill, there will be a loss of the interest of $320 for 2 days, or $13440 for 1 day. On the fourth bill, there will be a loss of the interest of $976 for 57 days, or $55632 for 1 day. If all the bills are paid Apr. 10, there will be a loss to the payer of the interest of $71312 for 1 day, or of $1550 for 46 days. Since the loss of interest to the payer is equivalent to the interest of the total amount of the bills for 46 days, it is evident that the day when there would be no loss of interest must be 46 days after Apr. 10, or May 26. The payer is entitled to defer payment 46 days after the assumed date as a compensation for the estimated loss.

The gain of interest to the payer on the first three bills, which are paid after they are due, equals the loss of interest on the fourth bill, which is paid before it is due.

PROOF.

The interest of $114 for 46 days at 6% is $0.874
" " " 140 " 30 " " 70
" " " 320 " 4 " " 213
Total gain of interest to the payer 1.787
The interest (a loss to the payer) of $976 for 11 days is . 1.789

NOTES.—1. In finding the number of days from the assumed date to the other dates, instead of calculating from the assumed date each time, find the interval from one date to the next and add it to the last number of days. Thus, from Apr. 10 to May 22 is 42 days, and from May 22 to June 6, 15 days; hence, from Apr. 10 to June 6 is 57 (42 + 15) days. (See Art. **210**, Ex. 3.)

2. To determine the due date, find the number of days in the operation nearest to the quotient, and add or subtract, as may be necessary, the difference between it and the quotient, to its corresponding date. Thus, in the above example, the number of days in the operation nearest to the quotient is 42; hence the due date is 4 (46-42) days after May 22, or May 26. (See Art. **254**, Ex. 3.)

3. If the fraction of the quotient is less than ½, disregard it; if more than ½, add 1 day to the integral number of days in the quotient.

435. RULE FOR THE PRODUCT METHOD.—*Assume the earliest due date as the day of settlement for all the items. Multiply each item by the number of days intervening between the assumed date of settlement and the date of the item; and divide the sum of the several products by the sum of the account. Count forward from the assumed date the number of days obtained in the quotient. The result will be the equated time.*

436. OPERATION.—FIRST INTEREST METHOD.

		Days.	Interest.
Due Apr. 10,	$114	0	$.00
" " 26,	140	16	.233 for 10 days. .14 " 6 "
" May 22,	320	42	1.60 " 30 " .64 " 12 "
" June 6,	976	57	4.88 " 30 " 2.44 " 15 " 1.952 " 12 "
	60) 15.50		
	.258		) 11.885 (46 days after Apr. 10, or May 26.

ANALYSIS.—Assume Apr. 10, the earliest due date, as the time of settlement. If the total amount ($1550) of the bills is paid Apr. 10, the assumed date of settlement, there will be a loss of interest to the payer of $11.885. The interest of $1550 for 60 days at 6% is $15.50, and for 1 day, $0.258. It will take $1550 to produce $11.885 interest as many days as $0.258 is contained times in $11.885, or 46 days. If, at the assumed date of settlement, there is a loss to the payer of the interest of $1550 for 46 days, the true day of settlement must be 46 days later, or May 26.

437. OPERATION.—SECOND INTEREST METHOD.

Mo.		Days.		Interest.	
0	Apr.	10,	$114	$0.19	
0	"	30,	140	.466	for 20 days.
				.14	" 6 "
				1.60	" 1 mo.
1	May	32,	320	1.067	" 20 days.
				.107	" 2 "
				9.76	" 2 mo.
2	June	6,	976	.976	" 6 days.
			$1550		
			7.75	14.306	1 mo. 25 da. after Mar. 31,
				7.75	or May 25.
				6.556	
				30	

7.75) 196.680 (25 days.
1550
4168
3875
293

ANALYSIS. By this method, the last day of the month preceding the earliest due date is assumed as the date of settlement, and the time is found by Compound Subtraction, each month being regarded as 30 days.

The months are placed on the margin and the days correspond with the number of days in the given dates.

Mar. 31 the assumed day of settlement, there is a loss to the payer of $14.306 interest, or the interest of $1550 for 1 *mo.* 25 *da.* The equated time is therefore 1 *mo.* 25 *da.* after Mar. 31, or May 25.

Since this method regards all months as 30 days each, its results are not strictly accurate. The error in this example is 1 day. (See preceding results.)

When this method is used, and accurate results are required, the necessary corrections may be made by adding to the intervals of time 1 day for each intervening month containing 31 days. If the month of February is included, 2 days should be subtracted in a common year and 1 day in a leap year.

[illegible] and the equated time, the opposite correction [illegible] the 30 and the quotient is [illegible] days being subtracted for [illegible]

[illegible] given example, 1 day [illegible] May. The result [illegible] these methods.

OPERATION.

Mo.	Days.		Interest.
0	Apr. 10,	$114	$0.19
0	" 26,	140	.466 for 20 days. .14 " 6 "
1	May 22,	320	1.60 " 1 mo. 1.067 " 20 days. .107 " 2 "
2	June 6+1,	976	9.76 " 2 mo. .976 " 6 days. .162 " 1 "
		2) 15.50	
		7.75)	14.468 (1 *mo.* 26 *da.* after Mar. 31, or May 26.

7.75

6.718

30

7.75) 201.540 (26 days.

EXAMPLES.

438. *1.* At what date may the following bills be paid in one amount without loss of interest to either party? Due Sept. 10, $145; Sept. 28, $144; Oct. 8, $75; Oct. 23, $512.

2. What is the equated time for the payment of the following bills? Due Mar. 28, $446; May 3, $212; May 15, $116; May 31, $475; June 12, $345.

3. What is the average due date of the following bills, each being due at the date given? Jan. 5, $127.85; Jan. 26, $134.18; Feb. 5, $249.40; Feb. 23, $418.73; Feb. 28, $176.25.

NOTE.—The result will be practically the same if the nearest dollar is used in multiplying or in calculating the interest. Thus, in the above example, regard the amounts as 128, 134, 249, 419, and 176 respectively.

When there are several items in the example, some accountants omit the cents and units of dollars, and use the nearest number of tens. Thus, if the above account were of sufficient length, the numbers might be regarded as 13, 13, 25, 42, and 18 respectively. In this example the result is the same, but in some examples, containing the same number of items, there would be a discrepancy of one or more days.

4. Sold a customer bills at the due dates and to the amounts specified: June 1, $152.73; June 15, $114.28; July 16, $247.84; July 25, $88.90; Aug. 18, $735.42; Aug. 29, $416.34. When may the whole indebtedness be equitably discharged at one payment?

5. Average the following account:

New York, *July 1, 1882.*

Messrs. Rice, Stix & Co.,

To Lord & Taylor, *Dr.*

1882.				
Apr.	4	Mdse. 30 days per bill rendered. . .	$816	37
"	21	" 30 " " " . .	724	25
May	13	" 30 " " " . .	342	46
"	25	" 30 " " " . .	535	84
June	[illegible]	" 30 " " " . .	[illegible]	62
		Due by equation June [illegible], 1882.	[illegible]	[illegible]

Note.—When several bills are sold on a common term of credit, first find the average date of purchase, and to the result add the common term of credit.

Certain merchants sell uniformly on the same term of credit, while others sell on different credits, depending upon the class of goods, the standing of the customer, the state of the market, &c. See Art. [illegible].

6. [illegible] Hamilton bought of [illegible] Leggett & Co. several bills of goods, as follows:

May 16, a bill of $[illegible] on 60 days' credit.
" 28, " [illegible]18.40 " 60 " "
June [illegible], " [illegible] " 60 " "
" 21, " [illegible] " 60 " "
July 13, " [illegible]35.60 " 60 " "

A [illegible] note for the whole amount is given in settlement. What must be its date, no allowance being made for the days of grace?

[illegible] on a credit of [illegible] days the following bills of goods: [illegible] May 3, [illegible] is the [illegible] time of payment [illegible] account [illegible]

[illegible] customers the [illegible] account is charged [illegible] certain date [illegible] date [illegible] the time [illegible] the average date [illegible]

Since a fraction of a day is not considered in determining the average date, this method of finding the cash balance is not as accurate as that of Art. 453, in which the interest is reckoned on each item separately.

8. A commission merchant sold several bills of goods, on a credit of 4 months, as follows: Aug. 16, 1881, $387; Sept. 4, 1881, $243.60; Sept. 18, 1881, $637.75; Oct. 28, 1881, $165.50; Dec. 10, 1881, $856.45. What is the equated time of payment?

NOTE.—The above account may be averaged by first finding the average date of purchase, and adding the common term of credit; or by finding the due date of each bill separately, and determining the average due date from the dates thus found. Since the months have not uniformly the same number of days, the results by the two methods sometimes differ by one or more days, when the common term of credit is expressed in months.

9. Bought goods on 6 months' credit as follows: Feb. 16, 1881, $376.50; Mar. 12, 1881, $287.40; Mar. 19, 1881, $612.87; Apr. 5, 1881, $345.60; Apr. 26, 1881, $134.80; June 1, 1881, $612.35. What is the average time of maturity? How much would balance the account Jan. 1, 1882? How much Oct. 1, 1881?

10. Park and Tilford sold to R. M. Bishop & Co. the following bills of merchandise on 60 days' credit: Feb. 24, $176.82; Feb. 28, $327.49; Mar. 16, $282.75; Mar. 28, $512.14; Apr. 7, $438.36; Apr. 14, $109.70; May 1, $632.65. What is the equated time of payment, and how much would be required to balance the account June 1? How much July 1?

11. The following bills of merchandise were purchased on 4 months' credit: June 1, $237.16; June 18, $146.75; June 30, $333.84; July 5, $416; July 16, $535.62; July 27, $912.33; Aug. 13, $345.60. A note payable in 4 months was given in settlement. What was its date, no allowance being made for the days of grace?

12. Bought goods on 60 days' credit as follows: Aug. 11, $487.60; Aug. 20, $398.30; Sept. 1, $411.26; Sept. 13, $283.36; Sept. 22, $112.43; Sept. 30, $555.55; Oct. 20, $342.48; Nov. 4, $337.64. What is the average due date?

13. What is the average time for the payment of the following bills, each being sold on a credit of 4 months? Feb. 29, $224.37; Mar. 13, $642.50; Mar. 31, $377.65; May 4, $510.10; May 19, $388.84; June 3, $476.25; June 19, $227.30; June 30, $562.75.

[illegible] several bills of goods as stated below:

June 3, a bill of $875 on 30 days' credit.
" 28, " " 480 " 60 " "
July 16, " " 560 " 4 months' "
Sept. 4, " " 228 " 90 days' "

What is the equated time of payment?

[illegible] the bills are sold on different terms of credit, first find the [illegible] payment, as in the following operation.

OPERATION.—[illegible] METHOD.

[illegible]	Due.		Amount.	Days.	Products.
[illegible]	July 3,		$875 ×	0 =	0
[illegible]	Aug. 27,		480 ×	55 =	[illegible]
[illegible]	Nov. 16,		560 ×	[illegible] =	[illegible]
[illegible]	Dec. 3,		228 ×	[illegible] =	[illegible]
			[illegible]		) [illegible] ([illegible] days.

OPERATION.—[illegible] METHOD.*

[illegible]			Credit.	Interest.		
[illegible] June 3,	$875,	30 days.		$4.375	for	1 mo.
				[illegible]	–	3 days.
[illegible] " 28,	480,	60 "		[illegible]	–	2 mo.
				[illegible]	–	24 days.
				[illegible]	–	4 "
				[illegible]	–	4 mo.
[illegible] July 16,	560,	4 mo.		[illegible]	–	1 "
				.933	–	10 days.
				[illegible]	–	6 "
				[illegible]	–	6 mo.
[illegible] Sept. 4,	228,	90 days.		[illegible]	–	4 days.

[illegible] 3 mo. 26 *da.* after
[illegible] May 31, or Sept. 26.

[illegible] 26 days.

[illegible]

15. What is the equated time for the payment of the following bills?

July	5,	1882,	$516.60	on	4 months'	credit.
	28,	“	327.35	“	60 days'	“
Aug.	15,	“	147.84	“	4 months'	“
Sept.	8,	“	485.42	“	30 days'	“
“	25,	“	230.39	“	60 “	“

16. Sold several bills of goods as follows:

May	4,	a bill of	$418.75	on	30 days'	credit.
“	16,	“	322.86	“	60 “	“
June	1,	“	513.44	“	4 months'	“
“	12,	“	118.70	“	60 days'	“
“	30,	“	786.30	“	6 months'	“
July	16,	“	274.85	“	60 days'	“

What is the average time of payment, and how much would balance the account Sept. 1? How much Oct. 1?

17. What is the average time of maturity for the payment of the following bills?

Mar.	4,	1883,	$117.26	on	4 months'	credit.
“	21,	“	97.43	“	30 days'	“
“	29,	“	243.84	“	60 “	“
Apr.	16,	“	376.14	“	4 months'	“
“	30,	“	182.75	“	90 days'	“
May	18,	“	412.50	“	60 “	“
June	1,	“	518.65	“	30 “	“

18. Bought goods of Henry Welsh as follows:

Nov.	13,	1881,	a bill of	$138.42	on	30 days'	credit.
“	30,	“	“	416.10	“	60 “	“
Dec.	16,	“	“	324.70	“	30 “	“
Jan.	5,	1882,	“	586.85	“	4 months'	“
“	26,	“	“	234.38	“	60 days'	“
Feb.	12,	“	“	93.60	“	4 months'	“
“	23,	“	“	618.75	“	30 days'	“
Mar.	5,	“	“	374.36	“	60 “	“

What is the equated time for the payment of the whole?

19. A commission merchant made the following sales for a consignor:

May 10,	$175,	on a credit of	4	months, or	30	days	less 5%.
" 18,	243,	"	4	"	30	"	"
" 31,	364,	"	4	"	30	"	"
June 18,	387,	"	4	"	30	"	"
July 1,	216,	"	4	"	30	"	"

What is the average due date?

NOTE.—Since each of the above bills was sold on two different terms of credit, the account may be averaged on two different bases producing different results. The average date of purchase is June 5. If the account is settled on the first term of credit, the total amount of the bills, $1385, will be due 4 months after June 5, or Oct. 5. If the account is settled on the second term of credit, there will be $1315.75 ($1385 less 5%) due 30 days after June 5, or July 5. Since money is always worth less than 20% (4 x 5%), the second method is in favor of the commission merchant. Probably most of his buyers settle their bills on the second terms, and thus take advantage of the discount

20. Average the following account on both terms of credit:

Jan. 16,	$387.65	on	6	months' credit	less 4%	30	days.
" 28,	117.42	"	6	"	"	30	"
Mar. 1,	482.60	"	6	"	"	30	"
" 13,	618.32	"	6	"	"	30	"
Apr. 4,	291.50	"	6	"	"	30	"
" 11,	433.75	"	6	"	"	30	"
" 23,	877.42	"	6	"	"	30	"

21. A commission merchant made the following sales: Aug. 1, 1881, $387.40; Aug. 10, 1881, $416.75; Sept. 5, 1881, $583.28; Sept. 20, 1881, $144.13; Oct. 3, 1881, $582.76; Oct. 24, 1881, $327.41. What is the net amount and the average due date if the goods were sold on the following time? "60 days, or 2% discount if paid in 10 days."

22. A commission merchant sold the bills mentioned below on the following terms: Net 60 days, or 1% discount in 30 days, or 2% discount in 10 days. Apr. 19, $327.85; May 1, $282.64; May 13, $117.49; June 18, $486.40; June 30, $380.36; July 10, $516.64; July 17, $222.27. What is the net amount and the due date on each term of credit?

23. Average the following sales made by a commission merchant for a consignor:

Mar. 18,	$428.32	on	4 months'	credit,	or 30 days	less 5%.
" 31,	385.74	"	60 days'	"		
Apr. 5,	212.50	"	4 months'	"	"	"
" 26,	678.34	"	30 days'	"		
May 10,	824.60	"	4 months'	"	"	"

NOTE.—If the 1st, 3rd, and 5th items are settled on the basis of 4 months' credit, the operation would be as follows by the product method:

OPERATION.

Due July 18,	$428.32	×	53	=	22684	
" May 30,	385.74	×	4	=	1544	
" Aug. 5,	212.50	×	71	=	*****	
" May 26,	678.34	×	0	=	0	
" Sept. 10,	824.60	×	107	=	*****	
	2529.50			)	******	(** days after May 26.

NOTE.—If the 1st, 3rd, and 5th items are settled on a credit of 30 days less 5%, the operation would be as follows:

OPERATION.

Due Apr. 17,	$428.32	×	0	=	0	
" May 5,	212.50	×	18	=	3816	
" June 9,	824.60	×	53	=	43725	
	1465.42				47541	
Less 5%	73.27				2377	
	1392.15				45164	
" May 30,	385.74	×	43	=	*****	
" " 26,	678.34	×	39	=	*****	
	2456.23			)	*****	(** days after Apr. 17.

24. Find the average time for the payment of the following sales:

Mar. 16,	$874.42	on	30	days'	credit.	
" 31,	555.37	"	60	"	"	
Apr. 5,	677.30	"	60	"	"	
" 16,	426.76	"	30	"	"	
" 24,	388.65	"	4	months'	"	or 30 days less 5%.
May 3,	112.60	"	4	"	"	" 30 " " 5%.
" 10,	989.10	"	60	days'	"	

[illegible] the following sales :

4, 1[illegible], $187.16 on 6 months' credit, or 30 days less 4%.
16, " 332.40 " 30 days' "
24, " 512.75 " 6 months' " or 30 days less 4%.
5, " 164.60 " 6 " " " 30 " " "
2[illegible], " 182.30 " 6 " " " 30 " " "
5, " 498.75 " 60 days' "
17, " 128. " 6 months' " or 30 days less 4%.

[illegible]. Average the following account :

Dec. 1, 1882, $[illegible].75 on 30 days' credit.
" [illegible] " [illegible] " [illegible] " "
" " [illegible] " 4 months' " less 5% 30 days.
[illegible] 1883, [illegible] " 4 " " " 5% 30 days.
" [illegible] " [illegible] " [illegible] days' "
[illegible] 4, " [illegible] " 4 months' " less 3% 30 days.

To find the equated time for the payment of the balance of an account having both debit and credit items.

1[illegible] [illegible] what time was the balance of the following account due, [illegible] to either party?

[illegible] [illegible] in account with Geo. H. Stark. Cr.

[illegible]	[illegible]	[illegible]	July 26	Cash	400	00
" 28	[illegible]	[illegible]	Aug. 10	"	375	00
[illegible]	[illegible]	[illegible]	" 10	Mdse. 60 da.	288	00
" 26	[illegible]	[illegible]				

111. OPERATION. PRODUCT METHOD.

Due	Dr.		Due	Cr.	
July [illegible],	$[illegible] × [illegible] =	[illegible]	July 26,	$400 × [illegible] =	$[illegible]
Aug. [illegible],	[illegible] × [illegible] =	[illegible]	Aug. 10,	375 × [illegible] =	1[illegible]
Oct. [illegible],	[illegible] × [illegible] =	[illegible]	Oct. [illegible],	288 × [illegible] =	[illegible]
[illegible]	[illegible] × [illegible] =	[illegible]		[illegible]	[illegible]
		[illegible]			
		[illegible]			

[illegible] days after [illegible]

ANALYSIS.—First find the due date of each item. For convenience, assume July 6, the earliest due date, as the day of settlement for all the items on each side of the account. (See Art. **433,** Note 2.) If the balance of the account is paid July 6, the assumed date of settlement, there would be a loss to the payer, on the debit side of the account, equivalent to the interest of $98376 for 1 day, and on the credit side, of $48485 for 1 day; or a net loss of $49891 for 1 day, or of $545 for 92 days. Since the loss of interest to the payer by settling the account July 6, is equivalent to the interest of the balance, or the amount paid, for 92 days, it is evident that the day when there would be no loss of interest must be 92 days after July 6, 1882, or Oct. 6, 1882.

If the greater sum of the products had been on the credit side, there would have been a gain to the payer by settling the account July 6, and the day that the balance of the account would commence to draw interest would have been 92 days before July 6, or Apr. 5, 1882.

442. RULE FOR THE PRODUCT METHOD.—*First find the due date of each item. Assume the earliest due date as the day of settlement for all the items on both sides of the account. Multiply each item by the number of days intervening between the assumed date of settlement and the due date of the item, and find the sum of the products on each side of the account. Divide the balance (the difference between the sums of the debit and credit products) of the products by the balance of the account. The quotient will be the number of days intervening between the assumed date and the true date of settlement.*

To find the true date of settlement, count forward from the assumed date, when the balance of the account and the balance of the products are on the same side (both debits or both credits); and count backward, when on opposite sides.

NOTE.—1. The rule for counting backward and forward is the reverse of the above, when the latest date or a date after the latest date is taken as the assumed date of settlement.

2. Although the principles of equation of accounts are theoretically correct, they are not always practicable and can not be legally enforced. Thus, if a debt of $4000 is due Feb. 1, no merchant would accept a payment of $3600, Jan. 1, with the understanding that the remaining $400 would remain unsettled 9 months after Feb. 1, or until Nov. 1. The merchant would undoubtedly be willing to allow a discount equivalent to the interest of $3600 for the unexpired time, or 1 month.

3. In finding the equated time, reject the cents when less than 50; and add 1 dollar to the dollars when the cents are more than 50. The results will be sufficiently accurate.

443. OPERATION.—FIRST INTEREST METHOD.[*]

	Dr.				*Cr.*		
Due		Days.	Interest.	Due		Days.	Interest.
July 6,	$456	0	$0.00	July 26,	$400	20	$1.333
Aug. 19,	384	44	2.816	Aug. 10,	375	35	2.187
Oct. 5,	216	91	3.276	Oct. 9,	288	95	4.56
" 26,	552	112	10.304		1063		8.080
	1608		16.396				
	1063		8.08				

60) 5.45) 8.3160 (92 days after July 6, or

.0908 Oct. 6, 1882.

ANALYSIS.—If the account is settled July 6, the assumed date of settlement, Mr. R. would be entitled to a discount on the debit side of $16.396, and Mr. S. on the credit side of $8.08; or, Mr. R. would be entitled to a net discount of $8.316. If, by paying the balance of the account, July 6, Mr. R. is entitled to a discount of $8.316, it is evident that he should be allowed to defer payment until the balance would produce an equivalent interest, or 92 days. Hence, the true date of settlement is 92 days after July 6, 1882, or Oct. 6, 1882.

When the balance of the account and the balance of interest are both due the same party, the equated time is previous to the assumed date of settlement; and, when the balance of the account and the balance of interest are due different parties, the equated time is after the assumed date.

444. In the following operation, the latest due date is assumed as the date of settlement for all the items:

OPERATION.

Due		Days.	Interest.	Due		Days.	Interest.
July 6,	$456	112	$8.512	July 26,	$400	92	$6.133
Aug. 19,	384	68	4.352	Aug. 10,	375	77	4.812
Oct. 5,	216	21	.756	Oct. 9,	288	17	.816
" 26,	552	0	.00		1063		11.761
	1608		13.620				
	1063		11.761				

60) 5.45 .0908) 1.8590 (20 days before Oct. 26, or

.0908 Oct. 6, 1882.

ANALYSIS.—If the account is settled Oct. 26, the assumed date of settlement, the payer will be obliged to pay $1.859 interest in addition to the balance of the account. Hence, the date when the balance only may be paid without loss to either party must be 20 days before Oct. 26, 1882, or Oct. 6, 1882.

---

[*] See Art. 436.

Analysis.—First find the due date of each item. For convenience, assume July 6, the earliest due date, as the day of settlement for all the items on each side of the account. (See Art. **433,** Note 2.) If the balance of the account is paid July 6, the assumed date of settlement, there would be a loss to the payer, on the debit side of the account, equivalent to the interest of $98376 for 1 day, and on the credit side, of $48485 for 1 day; or a net loss of $49891 for 1 day, or of $545 for 92 days. Since the loss of interest to the payer by settling the account July 6, is equivalent to the interest of the balance, or the amount paid, for 92 days, it is evident that the day when there would be no loss of interest must be 92 days after July 6, 1882, or Oct. 6, 1882.

If the greater sum of the products had been on the credit side, there would have been a gain to the payer by settling the account July 6, and the day that the balance of the account would commence to draw interest would have been 92 days before July 6, or Apr. 5, 1882.

442. Rule for the Product Method.—*First find the due date of each item. Assume the earliest due date as the day of settlement for all the items on both sides of the account. Multiply each item by the number of days intervening between the assumed date of settlement and the due date of the item, and find the sum of the products on each side of the account. Divide the balance (the difference between the sums of the debit and credit products) of the products by the balance of the account. The quotient will be the number of days intervening between the assumed date and the true date of settlement.*

To find the true date of settlement, count forward from the assumed date, when the balance of the account and the balance of the products are on the same side (both debits or both credits); and count backward, when on opposite sides.

Note.—1. The rule for counting backward and forward is the reverse of the above, when the latest date or a date after the latest date is taken as the assumed date of settlement.

2. Although the principles of equation of accounts are theoretically correct, they are not always practicable and can not be legally enforced. Thus, if a debt of $4000 is due Feb. 1, no merchant would accept a payment of $3600, Jan. 1, with the understanding that the remaining $400 would remain unsettled 9 months after Feb. 1, or until Nov. 1. The merchant would undoubtedly be willing to allow a discount equivalent to the interest of $3600 for the unexpired time, or 1 month.

3. In finding the equated time, reject the cents when less than 50; and add 1 dollar to the dollars when the cents are more than 50. The results will be sufficiently accurate.

[illegible] the following account:

Dr.				[illegible]			Cr.
[illegible]				[illegible]			
[illegible]	[illegible]	[illegible] mo.	[illegible]	[illegible]	[illegible]	Cash	300
[illegible]		[illegible] da.	[illegible]	[illegible]		"	400
[illegible]		[illegible] mo.	[illegible]	[illegible] 7		"	500
[illegible]		[illegible] mo.	[illegible]				

[illegible] is the equated time for the payment of the balance of the following account?

Dr.				[illegible] account with [illegible]			Cr.
[illegible]				[illegible]			
Mar. [illegible]	Mdse.	[illegible] mo.	[illegible]	July [illegible]	[illegible]	Cash	400
" [illegible]		[illegible] da.	[illegible]	"	[illegible]	"	375
Apr. [illegible]		[illegible] da.	[illegible] 12	Aug.	[illegible]	"	700
May [illegible]		[illegible] mo.	[illegible] 25	"	[illegible]	"	600
" [illegible]		[illegible] mo.	[illegible]				

[illegible] Average the following account. What will be the amount due Jan. 1, [illegible]2?

Dr.				C. in account with D.			Cr.
[illegible]				[illegible]			
June 16	Mdse.	30 da.	517 25	June 16	Note 60 (63) da.		1000
" 28	"	30 da.	487 50	July 30	Cash.		375
July [illegible]	"	4 mo.	316 75	Aug. 13	Mdse. 4 mo.		900
" 21	"	6 mo.	324 30	Oct. 5	Cash.		500
Aug. 12	"	4 mo.	317 65				

6. When will the balance of the following account commence drawing interest? How much would be due Mar. 1, 1883.

Dr.		ANDREW CARNEGIE, Pittsburg, Pa.					Cr.
[illegible]				[illegible]			
Sept. [illegible]	Cash		[illegible]00	Aug. 16	Mdse.	4 mo.	647 13
" [illegible]	Note 3 mo.		[illegible]00	" 29	"	4 mo.	322 85
Oct. 31	Cash		250	Sept. [illegible]	"	4 mo.	412 90
Dec. [illegible]	"		500	" [illegible]	"	4 mo.	588 33
				" [illegible]	"	30 da.	246 12
				Nov. [illegible]	"	4 mo.	683 45

7. Find the equated time for the payment of the balance of the following account.

Dr. James B. Farwell, Chicago, Ill. *Cr.*

1881.				1881.			
Jan. 4	Mdse. 4 *mo.*	637	20	Mar. 16	Cash.	300	00
" 14	" 4 *mo.*	412	87	Apr. 20	"	400	00
" 14	" 60 *da.*	214	35	May 3	"	200	00
Mar. 16	" 4 *mo.*	298	60	" 3	Note 4 *mo.*	800	00
" 28	" 30 *da.*	973	25				

8. Average the following account:

Dr. Arnold, Constable, & Co. *Cr.*

1882.				1882.			
Apr. 4	Mdse. 4 *mo.*	426	32	Apr. 25	Cash.	375	
" 20	" Cash.	387	40	June 30	"	600	
May 13	" 60 *da.*	622	39	July 31	Note 60 *da.*	600	
" 27	" 30 *da.*	584	75	Aug. 15	Cash.	500	
July 5	" 4 *mo.*	224	50	Oct. 31	"	400	
" 16	" 4 *mo.*	838	95				

447. To find the equated time for the payment of the net proceeds (282) of an account sales (283).

448. 1. The sales form the credit side of the account, and the charges and advances the debit side.

2. The charges for transportation, cartage, and other items paid by the commission merchant are considered due at the time of the payment of the same.

3. The commission and other after-charges of the commission merchant are considered due by some at the average *due* date of the sales; and by others, at the average date of the sales. Since the commission is so small compared with the gross sales, in many examples, it makes no difference which date the commission is considered due. Certain merchants enter the commission at the date the account sales is rendered, and, by so doing, produce a result sufficiently accurate.

4. Many commission merchants, when the consignments are not separated and numbered, enter the sales and commission only on the account sales (See Ex. 4, Art. **450**), and enter the advances

charges in the account current (See Ex. 6, Art. ... Account sales, when the shipments are continuous, are ... monthly to the manufacturers or consignors, and ... weekly or whenever a sale is made.

... the exception of finding the date for the commission ... other charges, the process of averaging an account sales ... the same as that of averaging an account containing debit and credit items.

449. *Ex.* What is the equated time for the payment of the proceeds of the following account sales?

NEW YORK, Dec. 1, 1881.

Account sales of Seed

For account of WILLIAM STEPHENS & Co.

By FRANKLIN EDSON & Co.

4	45^{44} *bu.* Timothy Seed . 30 *da.*	1^{75}	79	53		
18	50 " Mammoth Cl. Seed 60 *da.*	9^{00}	450			
25	49^{44} " Clover Seed . . Cash.	8^{40}	418	32	947	85
	CHARGES.					
31	Transportation.		60	00		
1	Commission 5% as Dec. 22, 1881. .		47	39	107	39
	Net proceeds due Dec. 26, 1881. . .				840	46

ANALYSIS.—The average due date of the sales is Dec. 22, 1881, which is taken as the due date for the commission.

The account sales to be averaged will now be as follows:

Dr.					Cr.			
Due	Oct. 31,	1881,	$60.00		Due	Dec. 4,	1881,	$79.53
"	Dec. 22	"	47.39		"	Jan. 17,	1882,	450.00
					"	Nov. 25,	1881,	418.32

By averaging the above, we find the net proceeds, $840.46, are due Dec. 26, 1881.

If the commission is considered due Nov. [illegible], 1881, the average date of the sales, the net proceeds will be due Dec. [illegible], 1881.

[illegible] ... at cash date, be taken in finding the average due date [illegible] as in finding the average due date of the net proceeds, [illegible] credit side of the latter operation.

EXAMPLES.

450. Find the net proceeds and equated time of the following accounts sales. (Unless otherwise stated, the commission is considered due at the average due date of the sales.)

1. Sales of 400 bbls. flour received per N. Y. C. & H. R. R. R., for account of A. W. ARCHIBALD, Ottumwa, Iowa.

1881.							
May	11	125 bbls. "Kirkwood" cash, . .	6^{75}	***	**		
"	12	150 " "Iowa" 4 *mo.*, .	6^{50}	***			
"	18	125 " "Kirkwood" 4 *mo.*, .	7^{00}	***		****	**
		CHARGES.					
May	3	Transportation and Cartage, . . .		425			
"	4	Inspection, ...		15			
"	18	Storage, ...		45			
		Commission and Guaranty 5%, . . .		***	**	***	**
		Net proceeds due per average, ——, 1881,				****	**

E. & O. E. E. R. LIVERMORE.

NEW YORK, May 20, 1881.

What would be the equated time for the payment of the above proceeds, if the commission and guaranty were considered due at the average due date of the sales? At the average date of the sales? If considered due May 18, the date of the last sale?

2. Account sales of 900 sides hemlock sole leather by MASSEY & JANNEY, for account of GRANT & HORTON, Ridgway, Pa.

1881.		Sides.	Description.	Terms.	Weight.	Price.				
Aug.	14	400	"Ridgway" #7	4 *mo.*	9407	27	****	**		
"	18	300	" #7	4 *mo.*	6875	27¼	****	**		
"	21	200	" #8	30 *da.*	4712	27¼	****	**	****	**
		CHARGES.								
Aug.	2	Transportation $70, Cartage $9, . .					**			
"	3	Inspection, ...					9			
		Commission and Guaranty 5%, . .					***	**	***	**
		Proceeds due ——, 1881, ...							****	**

E. & O. E. MASSEY & JANNEY.

PHILADELPHIA, PA., Aug. 22, 1881.

3. Find the equated time for the payment of the net proceeds of Ex. 27, Art. **286**, supposing that the merchandise was sold for cash, and that the commission was due at the date given.

4. Sales by James Talcott, New York, for account of Phenix Mills, Cohoes, N. Y. March 31, 1882.*

Date.		Cases.	No.	Description.	Time.	Yards.	Price.	Amount.
Mar.	1	2	7619	Fancy Cassimere,	30 da.	966²	1.35	****.**
"	10	4	3475	" "	10 da.	1994	1.70	****.**
"	13	3	4157	" "	30 da.	1506²	2.30	****.**
"	17	4	6283	" "	4 mo.	1936²	1.65	****.**
"	26	2	3971	" "	Cash.	978	1.85	****.**
								*****.**
				Less Commission 5%,				***.**
				Proceeds due ——, 1882,				*****.**

5. Account Sales of merchandise by John F. Cook, for account of Excelsior Packing Co., Cincinnati, Ohio.

1881.									
Oct.	16	50 Bbls.	Mess Beef,	Cash.	11^{25}	****	**		
"	24	100 "	N. M. Pork,	"	17^{50}	****			
"	31	25 "	Hams 6376 lbs.,	10 da.	$13\frac{3}{4}$¢	****	**		
Nov.	9	25 "	Shoulders 5717 lbs.,	60 da.	9¢	****	**		
"	18	75 "	C. M. Pork,	4 mo.	13^{25}	****	**	*****	**
			CHARGES.						
Oct.	13	Transportation,				325			
"	15	Cartage,				37	50		
"	15	Cooperage,				15			
"	15	Inspection,				13	75		
Nov.	18	Storage,				18	75		
		Commission 5%,				***	**	****	**
		Net proceeds due ——, 1881,						*****	**

E. & O. E. JOHN F. COOK.

NEW YORK, N. Y., Nov. 20, 1881.

---

* If the commission is considered due at the average due date of the sales, and since there are no other charges, the net proceeds will be due at the same date.

ACCOUNTS CURRENT.

DEFINITIONS.

451. An **Account Current** is an itemized account of the business transactions between two houses, showing the balance or amount due at the current date. The amount due is sometimes called the *cash balance.*

1. An account current is a transcript of the ledger account with the addition of certain details taken from the books of original entry, and is arranged in a different form.

2. Interest is charged, or not, according to the custom of the business, or the agreement between the parties. This chapter treats only of accounts in which interest is charged. When interest is not charged, the balance due is the difference between the two sides of the account as originally entered in the ledger. The interest may be reckoned according to any of the methods of Art. **299**. In the illustrative example the exact time in days is found, and the days are regarded as 360ths of a year. In the examples for practice, unless otherwise stated, the interest is reckoned on the same basis.

3. Accounts current are rendered by merchants, bankers, and brokers annually (Ex. 2), semi-annually (Ex. 1), quarterly (Ex. 3), or monthly (Ex. 6). Since the interest draws interest after the account is balanced, the oftener the account is balanced, or the interest is added to the account, the greater the amount due. Some merchants render partial accounts current monthly, but do not carry the interest to the main column until the end of the year (Ex. 11). The twelve partial accounts current make, when combined, the complete account current for the whole year.

4. There are three methods in common use for finding the amount due on an account, including interest, at a certain date, all of which are presented in the following illustrative example: 1. By interest; 2. By products; 3. By daily balances.

452. Ex. Find the amount due, including interest at 6%, on the following account Jan. 1, 1882.

Dr. Geo. W. Childs in account with A. A. Low. *Cr.*

1881.			1881.		
Oct. 1	Balance.	1800	Oct. 31	Cash.	1000
" 16	Mdse. 30 *da.*	360	Nov. 16	Note 30 *da.*	600
Nov. 27	" 30 *da.*	432	Dec. 4	Cash.	240
Dec. 18	Bill of H. C. & Co.	420	" 26	"	300

453. Operation.—Interest Method.

	Dr.				*Cr.*		
Due.	Amount.	Days.	Interest.	Due.	Amount.	Days.	Interest.
Oct. 1,	$1800	92	$27.60	Oct. 31,	$1000	62	$10.33
Nov. 15,	360	47	2.82	Dec. 19,	600	13	1.30
Dec. 27,	432	5	.36	" 4,	240	28	1.12
" 18,	420	14	.98	" 26,	300	6	.30
	$3012		$31.76		$2140		$13.05
	2140		13.05				
	872	+	18.71	= 890.71.			

Analysis.—First find the due date of each item of the account. Each item will draw interest from its due date until the day of settlement, or Jan. 1, 1882. The total interest on the debit side of the account is $31.76, and on the credit side, $13.05. The balance of interest, $18.71, is therefore in favor of the debit side, or is due Mr. Low.

Since both the balance of the account ($872) and the balance of interest ($18.71) are due the same party, the net amount due Jan. 1, 1882, is $872 plus $18.71, or $890.71.

If the balance of interest had been on the credit side of the account, the net amount due would have been $872 *minus* $18.71, or $853.29.

Notes.—1. It will sometimes happen that certain items will fall due after the day of settlement. The interest on such items should be transferred to the opposite side of the account. (See Ex. 8.)

2. If the account has been averaged, the amount due at a given date may be found by calculating the interest on the balance of the account from the time it is due to the date of settlement. If the date of settlement is earlier than the average date, subtract the interest from the balance of the account; if later than the average date, add the interest. (See Art. **438**, Ex. 7, Note.)

3. The interest method is generally used in business. Since it gives the interest on each item and is readily understood, it is more satisfactory to those to whom accounts current are sent than the product method. When interest tables are used, it is shorter than any other method.

454. The following is a common form of an account current including interest:

Dr. GEO. W. CHILDS in % current with A. A. LOW. *Cr.*

1881.		Days.	Interest.	Amounts.	1881.		Days.	Interest.	Amounts.
Oct. 1	Balance.	92	27.60	1800.00	Oct. 31	Cash.	62	10:33	1000.00
" 16	Mdse. as Nov. 15.	47	2.82	360.00	Nov. 16	Note as Dec. 19.	13	1.30	600.00
Nov. 27	" " Dec. 27.	5	.36	432.00	Dec. 4	Cash.	28	1.12	240.00
Dec. 18	Bill of H. C. & Co.	14	.98	420.00	" 26	"	6	.30	300.00
1882.					1882.				
Jan. 1	Bal. of Interest.			18.71	Jan. 1	*Bal. of Interest.*		18.71	
					" 1	" " *Account.*			890.71
			31.76	3030.71				31.76	3030.71
1882.									
Jan. 1	Balance.			890.71					

455. RULE FOR THE INTEREST METHOD.—*First find the due date of each item of the account. Then find the interest on each item from the date it becomes due to the day of settlement. The difference between the sums of the debit and the credit interest will be the balance of interest.*

To find the net amount due, when the balance of interest and the balance of items are on the same side, take their sum; when on opposite sides, take their difference.

456. OPERATION.—PRODUCT METHOD.

Dr.				*Cr.*			
Due.	Am't.	Days.	Products.	Due.	Am't.	Days.	Products.
Oct. 1,	$1800	× 92 =	165600	Oct. 31,	$1000	× 62 =	62000
Nov. 15,	360	× 47 =	16920	Dec. 19,	600	× 13 =	7800
Dec. 27,	432	× 5 =	2160	" 4,	240	× 28 =	6720
" 18,	420	× 14 =	5880	" 26,	300	× 6 =	1800
	$3012		190560		$2140		78320
	2140		78320	$872 + $18.71 = $890.71.			
	872		6) 112240				
			$18.706				

ANALYSIS.—By multiplying the number of dollars by the number of days, and taking the sum of the products on each side of the account, we find that the total debit interest is equivalent to the interest of $190560 for 1 day, and the total credit interest to the interest of $78320 for 1 day. The balance of interest is therefore equivalent to the interest of $112240 for 1 day. The interest of $1 for 1 day is $\frac{1}{6}$ of a mill (**311**, 3), and of $112240, 18706 ($\frac{1}{6}$ of 112240) mills, or $18.71. Since the balance of items ($872) and the balance of interest ($18.71) are both due the same party, the net amount due is their sum, or $890.71.

452. Ex. Find the amount due, including interest a the following account Jan. 1, 1882.

Dr. GEO. W. CHILDS in account with A. A. LOW.

1881.				1881.		
Oct. 1	Balance.	1800		Oct. 31	Cash.	
" 16	Mdse. 30 *da.*	360		Nov. 16	Note 30 *da.*	
Nov. 27	" 30 *da.*	432		Dec. 4	Cash.	
Dec. 18	Bill of H. C. & Co.	420		" 26	"	

453. OPERATION.—INTEREST METHOD.

	Dr.				*Cr.*	
Due.	Amount.	Days.	Interest.	Due.	Amount.	Days.
Oct. 1,	$1800	92	$27.60	Oct. 31,	$1000	62
Nov. 15,	360	47	2.82	Dec. 19,	600	13
Dec. 27,	432	5	.36	" 4,	240	28
" 18,	420	14	.98	" 26,	300	6
	$3012		$31.76		$2140	
	2140		13.05			
	872	+	18.71 = 890.71.			

ANALYSIS.—First find the due date of each item of the accoun item will draw interest from its due date until the day of settlement 1, 1882. The total interest on the debit side of the account is $31.7 the credit side, $13.05. The balance of interest, $18.71, is therefore of the debit side, or is due Mr. Low.

Since both the balance of the account ($872) and the balance of ($18.71) are due the same party, the net amount due Jan. 1, 1882, is $ $18.71, or $890.71.

If the balance of interest had been on the credit side of the acc net amount due would have been $872 minus $18.71, or $853.29.

NOTES.—1. It will sometimes happen that certain items will after the day of settlement. The interest on such items should be m to the opposite side of the account. (See Ex 8.)

2. If the account has been averaged, the amount due at a given be found by calculating the interest on the balance of the account time it is due to the date of settlement. If the date of settlement than the average date, subtract the interest from the balance of the is later than the average date, add the interest. (See Art. 438, Ex

3. The interest method is generally used in business. Since it interest on each item and is readily understood, it is more satisfac when accounts current are sent than the product method. W tables are used, it is shorter than any other method.

[illegible] account current [illegible]

[illegible] Method. *First find the* [illegible] *account. Then find the* [illegible] *due to the day of* [illegible] *between the sums of the debit* [illegible] *the balance of interest* [illegible] *when the balance of interest* [illegible] *on the same side take their* [illegible] *take their difference.*

[illegible] Method.

[illegible]

457. Operation.—By Daily Balances.

Date.	Dr.	Cr.	Dr. Balances.	Days.	Dr. Products.
Oct. 1	1800		1800	30	54000
" 31		1000	800	15	12000
Nov. 15	360		1160	19	22040
Dec. 4		240	920	14	12880
" 18	420		1340	1	1340
" 19		600	740	7	5180
" 26		300	440	1	440
" 27	432		872	5	4360
	3012	2140		92	6) 112240
	2140				18.706

872 + 18.71 = 890.71.

Analysis.—Arrange the debit and the credit items in the order of their dates as in the operation. Find the balance of the items at each of the dates. There is a debit balance of $1800 for 30 days; the interest of which is equivalent to the interest of $54000 for 1 day. The interest of the next balance, $800, for 15 days is equivalent to the interest of $12000 for 1 day, etc. The total balance of interest is equivalent to the interest of $112240 for 1 day, or $18.71. The net amount due is $872 plus $18.71, or $890.71. (See Art. **311**, Note 3.)

Note.—If, at any time in the above operation, there had been a credit balance, it would have been necessary to have had additional columns for "Cr. Balances" and "Cr. Products."

EXAMPLES.

458. *1.* Find the balance due on the following account, Jan. 1, 1883, interest being reckoned at 6%.

Dr. Howard Thornton. *Cr.*

1882.				1882.			
July 1	Balance.	1830	45	Sept. 13	Net Proceeds.	876	40
Aug. 24	Mdse.	448	00	Oct. 31	" "	912	36
Oct. 18	Draft C. & C.	387	40	Nov. 5	Cash.	1000	00
Dec. 12	Draft H. & Co.	516	88				

2. What is the net amount due on the following account, July 1, 1882, at 6%?

Dr. C. H. Mills in % current with G. F. Swortfiguer. *Cr.*

1881.				1881.			
July 1	Balance.	1275	46	Nov. 14	Mdse. 4 *mo.*	587	19
Sept. 13	Draft #1012.	871	52	1882.			
1882.				Mar. 13	" 30 *da.*	612	35
Jan. 4	" #1017.	913	27	Apr. 27	" 60 *da.*	846	93
May 17	" #1024.	345	63	June 3	Cash.	500	00

3. What is the balance of the following account, Apr. 1, 1882, at 6%?

Dr. W. J. Hillis in account with Langrave Shults. *Cr.*

1882.				1882.			
Jan. 16	Dft. M. & C.	937	64	Jan. 1	Balance.	3456	75
" 31	" B. & D.	856	75	" 27	Sales as Mar. 15	1225	19
Mar. 3	" W. & Y.	1749	30	Feb. 4	Mdse as Mar. 6	673	75
" 24	" V. & C.	912	38	" 28	Sales as Mar. 19	2428	35

4. Find the amount due Aug. 1, at 6%, on the account represented in Ex. 7, Art. **438**. (See Note, Ex. 7, Art. **438**.)

5. Find the amount due Oct. 1, 1882, at 6%, on the account represented in Ex. 4, Art. **446**.

6. Find the balance due Apr. 1, 1882, at 6%, on the following account current.

Phenix Mills in % current with James Talcott, New York, Apr. 1, 1882.

Date.	Dr.	Amounts.		Date.	Cr.	Amounts.	
1882.				1882.			
Mar. 1	Balance.	45108	34	Mar. 31	Net Proceeds		
" 16	Draft #676.	1000			of Account		
" 18	" #675.	2000			Sales due Apr.		
" 24	" #678.	5000			26, 1882.'	12505	70
" 28	Cotton Bill.	3176	42		(See Ex. 4,		
" 30	Transportation.	875	10		Art. **450**.)		

7. Find the gain or loss on the following consignment account, taking as the day of settlement Jan. 29, 1881, the day the draft for the balance of the account was drawn and sold, and reckoning interest at 6% (365 days to the year).

Cons. F. L. Bruckmann, #14.

			Days.	Interest.		Amounts.	
1880.		*Dr.*					
Apr.	25	Mdse. Net Cash.	279	300	17	6544	72
"	25	Clearance.					20
May	10	Insurance.	***	[illegible]	[illegible]	40	
1881.							
Jan.	29	Balance of Interest to debit.				***	**
"	29	*Gain.*				***	**
				***	**	****	**
1880.		*Cr.*					
May	7	Draft 18000 Reichsmarks	267 ***	***	**	4258	42
Nov.	20	" 2000 "	7*	*	**	498	75
1881.							
Jan.	29	" 9998 "	0			2368	28
"	29	*Balance of Interest to debit.*		***	**		
				***	**	****	**

8. What was the amount due on the following account Feb. 13, 1881, the estimated due date of a sight draft drawn Jan. 29, 1881, for the balance, reckoning interest at 5% (365 days to the year)?

F. L. Bruckmann on account of Consignment #14.

				Days.	Interest.		Amounts.	
1880.		*Dr.*						
Oct.	25	Account Sales	due Jan. 9, 1881	35	44	80	9614	82
Dec.	31	" "	" Mar. 7, 1881				22417	54
1881.								
Feb.	13	*Balance of Interest to credit.*			***	**		
					***	**	*****	**
1880.		*Cr.*						
June	30	Freight	due May 14, 1880	***	**	**	1176	32
May	6	Draft 60 days' sight	" July 18, 1880	***	***	**	8000	
"	6	" 60 " "	" " 18, 1880				10000	
Nov.	19	" 60 " "	" Feb. 1, 1881	**	*	**	2000	
1881.								
Feb.	13	Interest Rm. 22417.54	" Mar. 7, 1881	**	**	**		
"	13	Balance of Interest to credit.					***	**
Jan.	29	Draft at sight *to balance*	due Feb. 13, 1881				****	**
					***	**	*****	**

Notes.—1. The interest on all items falling due after the day of settlement should be entered in the interest column on the opposite side of the account.

Some accountants enter these items of interest on the same side of the account in *red* ink so that they will not be added to the other items, and transfer the "red interest" in one amount to the opposite side.

2. The foregoing represents an account in German marks (reichsmarks) kept in an auxiliary book by a consignor of merchandise to a commission merchant at Hamburg, Germany.

The due dates of drafts, accounts sales, and other items are obtained from the letters from the commission merchant and from accounts sales and memoranda rendered by him. The corresponding consignment account as entered in the books of the consignor is represented in Ex. 7.

9. What was the balance due Jan. 1, 1882, at 6%, on the account represented in Ex. 5, Art. **446**.

10. Find the amount due Mar. 1, 1883, at 6%, on the account represented in Ex. 6, Art. **446**.

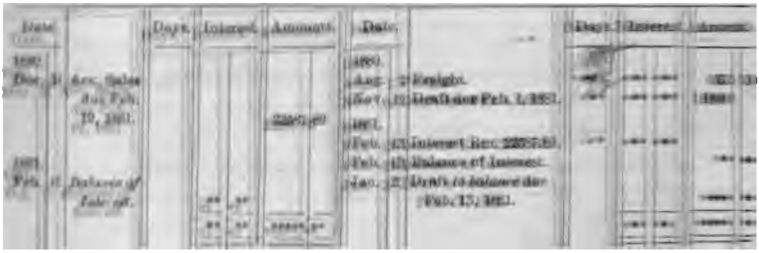
11. Calculate the interest Jan. 1, 1883, in the following partial account current, and find the total amounts. (Interest 6%, 365 days to the year.) (See Art. **451**, 3.)

G. D. Slocum in account with W. B. McMechan.

1882.		*Dr.*	Days.	Interest.		Amounts.	
May	1	Totals from statement of May 1. 1882.		1387	63	28765	72
"	6	Draft H. B. Claflin & Co.	240	50	71	1285	43
"	9	" Austin, Nichols & Co.	***	**	**	674	89
"	13	" W. H. Schieffelin & Co.	***	**	**	346	27
"	25	" Early & Lane.	***	**	**	418	43
"	28	" Mitchell, Vance & Co.	***	**	**	576	80
				****	**	*****	**
1882.		*Cr.*					
May	1	Totals from statement of May 1, 1882.		973	42	22413	71
"	5	Sales as June 28, 1882.	***	***	**	7316	84
"	12	" " Aug. 1, 1882.	***	**	**	2110	92
"	18	" " July 13, 1882.	***	***	**	13446	85
"	25	Cash.	***	**	**	2000	
				****	**	*****	**

12. Find the balance due on the following account Feb. 15, 1881. (5%, 365 days to the year.)

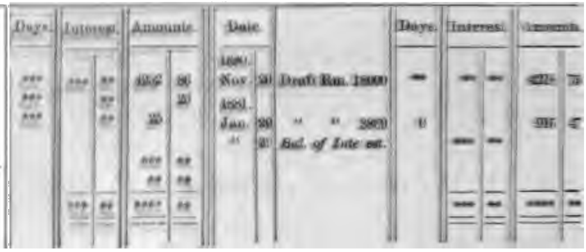
Dr. A. Weingreen & Co., on account of Cons. #25. *Cr.*



Date			Days	Interest	Amount	Date			Days	Interest	Amount
1880.						1880.					
Dec.	31	Acc. Sales due Feb. 10, 1881.			[illegible]	Aug.	2	Freight.	[illegible]	[illegible]	[illegible]
						Nov.	12	Draft due Feb. 1, 1881.	[illegible]	[illegible]	[illegible]
1881.						1881.					
Feb.	15	*Balance of Int. acc.*		[illegible]		Feb.	15	Interest Rec. [illegible]	[illegible]	[illegible]	
						Feb.	15	Balance of Interest.			[illegible]
						Jan.	2	*Draft to balance due Feb. 15, 1881.*			[illegible]
				[illegible]	[illegible]					[illegible]	[illegible]

13. Find the net gain or loss on the following consignment account, Jan. 29, 1881. (Interest 6%, 365 days to the year.)

Dr. Cons., A. Weingreen & Co., #25. *Cr.*



Date			Days	Interest	Amounts	Date			Days	Interest	Amounts
1880.						1880.					
June	31	Mdse.	[illegible]	[illegible]	[illegible]	Nov.	20	Draft Bal. 1800	[illegible]	[illegible]	[illegible]
July	:	Clearance.	[illegible]	[illegible]	20	1881.					
Aug.	1	Insurance.	[illegible]	[illegible]	25	Jan.	20	" " 2800	9		[illegible]
1881.						"	29	*Bal. of Interest.*		[illegible]	
Jan.	29	Bal. of Interest.			[illegible]						
"	29	*Gain.*			[illegible]						
				[illegible]	[illegible]					[illegible]	[illegible]

14. Find the amount due July 1, 1881, on the account represented in Ex. 7, Art. **446**.

15. What was the balance due Jan. 1, 1883, on the account represented in Ex. 8, Art. **446**?

16. Find the balance of the following account, Mar. 31, 1882, at 6%.

Dr. James A. Douglas in % current with J. H. Hoyt. *Cr.*

1882.					1882.				
Feb.	28	Balance.	18452	50	Mar.	8	100 N. Y.C.	14537	50
Mar.	2	Draft.	700		"	11	50 H. & St. J.	5162	50
"	11	100 N. W.	14062	50	"	17	Cash.	16000	
"	18	200 H. & St. J.	20875		"	24	100 N. W.	14437	50

17. What was the balance due Feb. 13, 1880, on the following account? (Interest 5%, 365 days to the year.)

F. L. BRUCKMANN on account of Consignment ♯10.

Date.			Days.	Interest.		Amounts.	
		Dr.					
1879.							
Jan.	23	Account Sales due Mar. 1, 1879.	***	****	**	21346	02
June	30	" " " Aug. 9, 1879.	***	***	**	9896	13
Dec.	31	" " " Feb. 25, 1880.				20834	43
1880.							
Feb.	13	*Balance of Interest to credit.*		***	**		
				****	**	*****	**
		Cr.					
1878.							
Oct.	22	Freight, as Oct. 22, 1878.	***	**	**	1298	55
Nov.	30	Telegrams, " Nov. 30, 1878.	***	*	**	88	
Dec.	10	Draft 60 days' sight due Feb. 25, 1879.	***	****	**	31000	
1879.							
Nov.	19	" 60 " " " Feb. 1, 1880.	**	**	**	10000	
1880.							
Feb.	13	Interest Rm. 20334.43 " " 25, 1880.	**	**	**		
Feb.	13	Balance of Interest to credit due Feb. 13, 1880.				***	**
Jan.	29	Draft at sight *to balance.*	0			****	**
				****	**	*****	**

18. Find the net gain or loss on the following consignment account. (Interest 6%, 365 days to the year.)

Cons., F. L. BRUCKMANN, ♯10.

Date.			Days.	Interest.		Amounts.	
		Dr.					
1878.							
Aug.	28	Mdse. Net Cash.	519	****	**	13028	48
"	30	Clearance.	***		**		20
Sept.	10	Insurance.	***	*	**	112	
1880.							
Jan.	29	Balance of Interest to debit.				***	**
				****	**	*****	**
		Cr.					
1878.							
Dec.	11	Draft 31000 Reichsmarks.	***	***	**	7283	79
1879.							
Mar.	26	Damage allowed by Insurance Co.	304 ***	**	**	1085	20
Nov.	20	Draft 10000 Reichsmarks.	76 **	**	**	2343	75
1880.							
Jan.	29	" 8826 "	0			2090	66
"	29	*Balance of Interest to debit.*		***	**		
"	29	*Loss.*				***	**
				****	**	*****	**

STOCKS AND BONDS.*

DEFINITIONS.

459. The term "Stock" is applied to the share capital of a company, and represents an interest in its property over and above its liabilities, and in the profits of its business after the expenses and interest on its bonds have been paid. This profit, when divided among the stockholders, is known as a *dividend*. The dividend is a certain amount per share, or a certain per cent. of the par value of the stock.

1. The Capital Stock of a company is divided into shares usually of $100 each. Shares of $50 and $25 are called half-stock and quarter-stock respectively.

2. A Stock *Certificate* is a written instrument issued by a company, and signed by the proper officers, certifying that the holder is the owner of a certain number of shares of its Capital Stock.

3. The sum for which the shares or certificates were issued is called the Par Value, and the amount for which they are sold, the *Market Value*.

460. Preferred Stock is one taking preference of the [illegible] or which a stated per cent. is [illegible] earnings before any dividend can be [illegible] stock.

[illegible] certain railroad are entitled to [illegible] earnings, before the common [illegible] payment, the balance of earnings [illegible] stock.

[illegible] reorganization of a railroad [illegible] may save the road from passing [illegible] sum of money, for which [illegible] preferred stocks have been issued [illegible]

[illegible] more classes of preferred stock.

---

* [illegible] Government Bonds, etc.," by Fisk &

461. A **Bond** is the obligation of a Corporation, City, County, State, or Government to pay a certain sum of money at a certain time, with a fixed rate of interest payable at certain periods, or, as in the case of income bonds, upon certain conditions.

1. Bonds of business corporations are usually secured by a mortgage on the whole or some specified portion of their property; although certain classes of bonds are issued without mortgage security, and are dependent on the good faith or solvency of the company issuing them, having the same force as a promissory note.

2. Bonds are issued with coupons attached representing the different installments of interest payable at the different periods specified, during the time the bond has to run, which are to be cut off and collected from time to time as the interest becomes due.

3. Bonds are also issued without coupons, in what is known as the registered form. In this case the bond is only payable to the registered owner, or his assignee, and the interest is paid by check or in cash, to the owner or his attorney.

4. Bonds are sometimes issued with coupons attached payable to bearer, but the principal of which may or may not be registered at the choice of the owner.

5. Bonds are known as First Mortgage, Second Mortgage, etc., Debentures, Consols, Convertible Land Grant, Sinking Fund, Adjustment, Income or otherwise, according to their priority of lien, the class of property upon which they are secured, or other characteristics. Income bonds are generally bonds on which the interest is only payable if earned, and ordinarily are not secured by a mortgage.

Bonds are also named from the rate of interest they bear, or from the dates at which they are payable or redeemable, or from both; as, U. S. 4's 1907, Virginia 6's, Western Union 7's, coupon, 1900, Lake Shore reg. 2d, 1903.

6. In speaking of the income from bonds the term "interest" is used, as it is the consideration received for the use of money loaned, while that derived from an investment in stock is called "dividend," because it is money divided to the stockholders from the profit of carrying on the business, after the fixed charges have all been paid.

7. The bond of a company may be a perfectly safe investment, when the stock is not; and the stock of a prosperous and successful company, paying large dividends or having a large surplus, may sell at a higher price than the bonds of the same company, the income from which is limited to the agreed rate of interest which they bear. A much closer scrutiny should be made of a company's standing, when one thinks of investing in its share capital, than when it is the intention to loan the company money on its mortgage bond.

8. *Convertible Bonds* are those which are issued with provisions whereby they can be exchanged for stock, lands, or other property.

9. Bonds are issued in denominations of $50 to $50000.

GOVERNMENT BONDS.

462. Statement of the Public Debt of the United States, January 1, 1882.

		Principal.	Interest.
INTEREST-BEARING DEBT.			
Bonds at 6%, continued at 3½%.		$149,682,900.00	$2,619,448.11
Bonds at 5%, continued at 3½%.		401,503,900.00	2,379,103.91
Bonds at 4½%.		250,000,000.00	1,394,299.62
Bonds at 4%.		738,772,550.00	8,149,645.31
Refunding Certificates (4%).		575,250.00	61,880.90
Navy-Pension Fund (3%).		14,000,000.00	210,000.00
		1,554,534,600.00	14,814,378.85
DEBT ON WHICH INTEREST HAS CEASED SINCE MATURITY.		11,528,265.26	714,985.31
DEBT BEARING NO INTEREST.			
Old Demand Notes, ...	59,920.00		
Legal-Tender Notes. (See Art. **189**.)	346,681,016.00		
Certificates of Deposit, . . .	9,590,000.00		
Gold Certificates, ...	5,188,120.00		
Silver Certificates. (See Art. **186**.)	68,675,230,00		
Fractional Currency,* . . .	7,075,926.92	437,270,212.92	
Unclaimed Pacific Railroad Interest.			7,256.51
		2,003,333,078.18	15,536,619.67
			2,003,333,078.18
TOTAL DEBT.			2,018,869,697.85
TOTAL CASH IN THE TREASURY.			253,377,980.76
DEBT, LESS CASH IN THE TREASURY, JAN. 1, 1882.			1.765,491,717.09

BONDS ISSUED TO THE PACIFIC RAILWAY COMPANIES, INTEREST PAYABLE BY THE UNITED STATES.

Principal outstanding, ...		$64,623,512.00
Interest accrued and not yet paid, ...		1,938,705.36
Interest paid by the United States, ...		51,467,272.02
Interest repaid by transportation of mails,	$14,707,886.34	
By cash payments 5% net earnings, .	655,198.87	15,363,085.21
Balance of interest paid by the United States, . . .		36,104,186.81

463. The quotations of government bonds at the New York Stock Exchange were as follows, Jan. 3, 1882:

	Bid.	Asked.		Bid.	Asked.
Sixes continued	101½	101⅝	U. S. cur. 6's, 1895	126	—
Fives continued	102⅛	102¼	U. S. cur. 6's, 1896	127	—
U. S. 4½'s, '91 reg.	114⅜	114⅝	U. S. cur. 6's, 1897	128	—
U. S. 4½'s, '91 c.	114⅜	114⅝	U. S. cur. 6's, 1898	129	—
U. S. 4's, 1907 reg.	117⅜	117⅝	U. S. cur. 6's, 1899	130	—
U. S. 4's, 1907 c.	117⅜	117⅝	Dist. of Col. 3–65's	107	108

---

* Amount of fractional currency estimated as lost or destroyed, $8,375,934.

All Government Bonds are dealt in and quoted "flat"—that is to say, the quoted market price is for the bond as it stands at the time, including the accrued interest—except that after the closing of the transfer books* the registered bonds are quoted ex-interest—that is to say, the interest then coming due belongs to the holder of the bond at the time of the closing of the books, and does not go with the bond to the purchaser.

In comparing the prices of the coupon and registered bonds during the period in which the transfer books remain closed, it should be remembered that during that time the quoted price of the coupon bonds includes the accrued interest falling due on the first of the ensuing month, while that of the registered bonds does not. If, in the month of December, when the books are closed preparatory to the payment of the interest due January 1, the coupon Four per cents are quoted at 118, the equivalent for the registered bonds of the same issue would be 117, the three months' interest being equal to one per cent.

464. Continued 6's, 6's of 1881. Authorized by Acts of July 17 and August 5, 1861, and March 3, 1863. Redeemable at the option of the government after June 30, 1881. During the year 1881, at the request of the holders, these bonds were *continued at 3½ per cent.* The amount outstanding Jan. 1; 1882, was $149,682,900, all registered. Interest is payable Jan. 1, and July 1. Although these bonds can be called at any time, the interest ceasing at the date of the call, it is the custom of the Secretary of the Treasury to give 60 days' notice.

465. Continued 5's, 5's of 1881. These bonds were authorized by the "Funding Acts" of July 14, 1870 and Jan. 20, 1871, and were issued for the purpose of funding the 5–20 and 10–40 bonds. Redeemable at the option of the Government after 10 years from their date, or after May 1, 1881. During the year 1881, at the request of the holders these bonds were *continued at 3½ per cent.* The amount outstanding Jan. 1, 1882, was $401,503,900, all registered. Interest is payable Feb. 1, May 1, Aug. 1, and Nov. 1. These bonds may be called at any time, but the interest will not cease till three months after the date of the call.

466. 4½'s of 1891. Authorized by the Acts of July 14, 1870, and Jan. 20, 1871, and issued for the purpose of funding the 5–20 and 10–40 bonds. Redeemable at the option of the Government

---

* The transfer books of U. S. registered bonds are closed for the month preceding the day on which the interest is paid.

[illegible] or after Sept. 1, 1891. The amount [illegible] was $250,000,000, of which [illegible] coupon bonds. Interest is payable [illegible]

[illegible] authorized by the Acts of July 14, 1870, [illegible] purpose of funding the 5-20 [illegible] option of the Government [illegible] July 1, 1907. The amount [illegible] of which [illegible] bonds. Interest is pay- [illegible]

[illegible] authorized by Act of Feb. [illegible] denomination of $10, bear [illegible] with accrued inter- [illegible] Jan. 1, 1882, was [illegible]

[illegible] issued to aid in the [illegible] authorized by the [illegible] and interest are [illegible] Payable 30 years [illegible] from 1895 to 1899. [illegible] was $64,623,512, all [illegible]

[illegible] of the various [illegible] and $1000. The [illegible] $100, $500, $1000, [illegible] 5's of 1881, the [illegible] in addition to the [illegible] $20,000 and [illegible]

[illegible] outstanding are ex- [illegible] Currency 6's. [illegible]

[illegible] pass by delivery [illegible] for sale and delivery than registered bonds, which must be assigned by the party in whose name they are registered. The interest coupons being also payable to the bearer will be cashed by any bank or banker in any part of the United States.

1. The interest on registered bonds is paid by checks, made to the order of the registered owner and sent to him by mail. These checks, when properly endorsed, can be collected and cashed through any bank or banker.

2. Coupon bonds may be converted into registered bonds of the same issue, but there is no provision of law for converting registered bonds into coupon bonds.

3. Coupon bonds forwarded to the Treasury Department for conversion into registered bonds should be addressed to "The Secretary of the Treasury, Washington, D. C."

4. Registered bonds forwarded to the Treasury Department for transfer, and requests for a change in the address to which interest checks are to be sent, should be addressed to the "Register of the Treasury, Washington, D.C."

NEW YORK STOCK EXCHANGE.

473. The **New York Stock Exchange** is an incorporated body of brokers, whose business it is to buy and sell stocks, bonds, and other representatives of value.

1. The present number of members is eleven hundred, the maximum allowed under the by-laws. Therefore, membership is only to be obtained by the purchase of the seat of a deceased or retiring member. Seats have been sold within the last few months (1882), for from $26000 to $31000.

2. The floor of the Exchange is open for business from 10 A. M. to 3 P. M. There are two regular calls of Stocks daily; three of State and Railroad Bonds; and three of United States Bonds. Transactions are not, however, confined to the regular calls, but are continually taking place on the floor of the Exchange between the hours named above.

3. In Wall Street, there are what are known as strictly commission houses, who take and execute orders for securities, charging the regular commission, and, when customers desire, loaning funds on the securities on a deposit of 10 to 20% of market value being made. This is what is known as buying on a margin (**478**), where the customer intends to sell soon again, and merely buys for speculative purposes. Such houses will usually sell stocks "short" (**480**, 11) for their customers on a similar margin.

There are other houses which make no advances, and require customers to pay outright for securities when bought.

Then, again, there are houses which combine a banking and brokerage business, taking deposits and loaning money on any securities marketable at the Exchange, and buying and selling stocks on commission. Some of these extend the privilege of marginal business to their customers, while others do not.

There are other members and firms who operate exclusively for their own account.

474. Quotations are made at so much per cent. on the basis of a par value of $100 per share of stock, except in the case of mining securities and Sutro Tunnel stock, which are quoted at so much per share, without reference to their par value.

For example, the par value of Morris and Essex stock is $50, but the quotation, if the stock were worth just par in the market, would be 100%; or, if the quotation is 110, it means $110 for $100 worth of the par value, which, in the case of this stock, would be two shares, while in the case of a stock the par value of which is $100 per share, it would be for one share.

On the other hand, if Sutro Tunnel, the par value of which is $10 per share, is quoted at 2, it means $2 per share; and, in like manner, if Homestake, the par value of which is $100, is quoted at 30, it means $30 per share.

475. Commission. The regular charge for buying and selling securities dealt in at the Stock Exchange, except mining stocks, is one-eighth of one per cent (⅛%) on par value, or $12.50 on 100 shares of stock of the par value of $100 each.

1. The commission on mining stocks varies with the market value of the stock. At present (1882), the rates charged at the Stock Exchange, on the mining stocks dealt in there, are as follows:

On Mining Stocks selling in the market at not over $5 per share,	$3.12½	per	100	shares.
On shares selling at not over $10 and above $5 per share,	6.25	"	100	"
On shares selling above $10 per share,	12.50	"	100	"

2. At the New York Mining Stock Exchange, where a large number of mining stocks not quoted at the Stock Exchange are dealt in, the regular scale of commissions is as follows:

Stocks	selling	under 50 cents per share,	Com. of	50 cents	per	100	shares.
"	"	at 50 cts. and under $1 per share,	"	$1.00	"	100	"
"	"	$1 " $2 "	"	2.00	"	100	"
"	"	2 " 5 "	"	3.00	"	100	"
"	"	5 " 10 "	"	5.00	"	100	"
"	"	10 " 20 "	"	6.25	"	100	"
"	"	20 and over per share,	"	12.50	"	100	"

476. Stocks are usually bought and sold either "cash," "regular way," "seller three" or "buyer three." A stock sold "cash" is deliverable the day sold; a stock sold "regular way" is deliverable the next day, or bought "regular way" is to be paid for the next day. Where nothing else is specified, "regular way" is always understood. When a stock is reported as bought "seller three," it is meant that the seller of the stock can deliver it on either of the three days at his option, but is not required to deliver until the third day. On the other hand, when a transaction is made "buyer three," the buyer can demand delivery of the stock at any time within three days, but must take it and pay for it by the third day.

Transactions on any of the above terms carry no interest.

If the option is over three days, six per cent. on the selling value of the stock is paid by buyer to seller.

One day's notice is required of intention to terminate an option of a longer period than three days.

The Stock Exchange does not recognize any contract for over sixty days. Should a stock pay a dividend during the pendency of a contract, the dividend belongs to the purchaser of the stock, unless otherwise previously agreed.

477. There are two lists of securities admitted to dealings at the Stock Exchange, viz.: (1) That which is regularly called every day; (2) that which is only called at request. The first list is known as the regular list, and the second as the free list.

478. A **Margin** is a deposit made with a broker, by a person who wishes to buy or sell stock for speculation to enable the broker to "carry" the stock and protect himself against loss. It is usually 10% of the par value of the stock.

1. A person desiring to speculate in stocks, deposits with his broker $1000 as a margin, and directs him to purchase 100 shares of a certain stock at 90. The broker would pay for the stock $9000, $1000 of which being furnished by the speculator, and the remainder, $8000, by the broker. The broker charges legal interest on the amount furnished by him for "carrying" the stock. (See Ex. 54, Art. **481**.)

2. The margin deposited with the broker is simply to protect the broker against losing any money should the stock move in the wrong direction. In case of its so doing, the margin must be made good by the deposit of an additional amount, otherwise the broker will sell the stock to protect himself from losing any of the money he has advanced.

129. A **Stock Privilege** is a contract by which the maker of the same engages to purchase, or to sell to, the bearer thereof, a [illegible] number of shares of some particular stock, at a certain price, at any time at the buyer's option within a certain period.

Stock Privileges are of four kinds, viz.: Puts, Calls, Spreads, and [illegible]. Stock Privileges are not dealt in at the Stock Exchange.

[illegible] contract by which the holder is entitled to call upon the [illegible] for a certain number of shares of a stock at a certain [illegible] within a certain period.

[illegible] CALL.

NEW YORK, ______ 18

[illegible] the undersigned [illegible] New York Central R. R. Co. at eighty- [illegible] days from the [illegible] regular or extra dividends [illegible]

[illegible] ....

[illegible] stock is notic- [illegible] from [illegible] above the

[illegible] value of the stock [illegible]

[illegible] stock is [illegible] and the above [illegible] market [illegible] contracts [illegible] as follows

[illegible]

4

[illegible]

EXAMPLE OF A PUT.

NEW YORK,________________188

For value received the bearer may deliver to the undersigned One Hundred Shares of the Chicago and Northwestern R. R. Co. Preferred Stock, at 135 per cent. of its par value, at any time within thirty days from this date. The undersigned is entitled to all regular or extra dividends declared during this time.

(Signed) ________________________

A Put is the reverse of a Call and becomes of value to the holder when there is a decline in the market. The contract price is from 2 to 5 per cent. below the market price of the stock.

3. A *Spread*, or Double Privilege is a combination of a Put and a Call.

4. A *Straddle* is a Spread, or Double Privilege, issued at the market price, instead of at a distance on each side of the market.

480. Explanation of Words and Phrases used in Wall Street.

1. *Bear.* An operator who is "short" of stock. He wishes to buy at a lower rate, and therefore tries to depress the price of the stock of which he is "short."

2. *Bull.* An operator who is holding stock for an advance. He is said to be "long" of the stock. Bulls try to advance the prices of the stocks of which they are "long."

3. *b. 3* (*Buyer 3*), *10, 20, 30, etc.* Meaning at the buyer's option, within three days, ten days, etc. When in a stock transaction, the buyer has the privilege of taking the stock at any time during the number of days mentioned. In buyer's options, when the option is for more than three days, six per cent. interest is charged the buyer, and the seller is entitled to one day's notice.

4. *b. c.*, "*between calls.*" The sale not taking place on the call of the stock, but after the first call and before the second.

5. *Collaterals.* Stocks, bonds, notes, or other value given in pledge as security, when money is borrowed.

6. *Cover, to* "*cover one's shorts.*" Where stock has been sold short, and the seller buys it in to realize his profit, or to protect himself from loss, or to make his delivery. This is "covering short sales."

7. *Differences.* When the price at which a stock is bargained for and the rate on day of delivery are not the same, the broker against whom the variation exists, frequently pays the "difference" in money, instead of furnishing or receiving the stock.

[illegible] of a stock does [illegible] declared [illegible]

7. The Union Pacific Railway paid to its stockholders, in 1879, $2,204,700. What was the par value of its stock, the rate of the dividend being 6%?

8. A quarterly dividend of 3½% was declared by a manufacturing company. What was the capital stock, the amount of the dividend being $2100?

9. If stock is quoted at 116⅝, what is the market value of 200 shares?

10. How many shares of W. U. Tel. can be bought for $43725 at 79⅞, brokerage ⅛%?

11. What is the total par value (**459**, 3) and the total market value of 100 shares Lake Shore at 118⅝ (**474**), 300 sh. N. J. Central at 89¾, 500 sh. W. U. Telegraph at 78¼, 200 sh. U. S. Express at 73½, and 500 sh. N. Y., L. E. & W. com. at 40⅞, and 800 sh. N. Y., L. E. & W. pref. (**460**) at 90¾?

12. What is the cost of 250 shares Tex. & Pac. at 50⅝ and 100 shares Ohio & Miss. pref. at 104, brokerage ⅛% (**475**)?

13. What are the proceeds of 600 shares Morris and Essex (half stock, **459**, 1) sold through a broker at 121½?

14. What are the proceeds of the following stocks sold through a broker? 200 shares Union Pacific at 117⅜, 2000 shares N. Y., O. & W. at 27¼, 800 shares A. & T. H. pref. at 88, and 600 shares Chi. & Alton at 131¼.

15. Find the cost of 10 shares Manhattan Bank at 135, $5000 Erie 7's (**461**, 5) cons. gold bonds (**461**) at 128, $1000 Toledo and Wabash 2d, a. 3 (**461**, 5—**480**, 10) at 108⅜, $5000 C. R. I. & P. 6's, 1907, coupon (**461**, 2) at 129, and $5000 Ohio Southern Income (**461**, 5) at 45, usual brokerage.

16. Find the proceeds of $15000 U. S. 4's, registered, 1907 (**467**), b. 3, at 117½, and $10000 U. S. 4½'s coupon (**466**) at 114½, usual brokerage.

17. How much must be invested in U. S. 4½'s, 1891, to produce a quarterly income of $675, bonds selling at 114⅜?

18. When Ohio 6's, 1886, are sold at 109½, what is received for six $500 bonds, brokerage ¼%?

19. When Pittsburg, Fort Wayne and Chicago 2d 7's, 1912, are worth 135, what will $12000 in bonds cost?

20. How many $500 bonds shall I receive for $4735 invested in U. S. 4's at 118⅜?

[illegible] How much must be sent to a broker that he may purchase [illegible] U. S. continued fives (**465**) at 102⅛, commission ⅛%?

[illegible] An investor sold Central of New Jersey stock at 52¼, and [illegible] with the proceeds $4200 in U. S. 4's, 1907, at 100⅝. W[illegible] the par value of the stock sold, usual brokerage?

[illegible] A broker bought on his own account 200 sh. Nor. Pac. pf. [illegible] the same day at 73¾. What was his gain?

[illegible] How many shares of [illegible] bought at 12[illegible] and sold at [illegible] brokerage, will produce a gain of $[illegible]?

[illegible] by investing $[illegible] in 4% [illegible]

[illegible] company is $[illegible],000,000, [illegible] stock (**460**) $[illegible]. The company declares [illegible] and [illegible]% on the common [illegible] earnings are $1,[illegible]45?

[illegible] pref. at 35[illegible], s 30. [illegible] What was the amount paid [illegible] (**480**).

[illegible] Lake Shore at 11[illegible], b. 60, and [illegible] What was the [illegible] including interest (**480**, [illegible])?

[illegible] at 65[illegible], s 3. Jan. 13, the [illegible] was the difference (**480**, 7) [illegible]

[illegible] including commission (**475**, 2) at the N. Y. Mining Stock Exchange [illegible] 500 sh. (par value $10) mining [illegible] What would have been the total cost, if bought [illegible] N. Y. Stock Exchange (**475**, [illegible])?

[illegible] States in refunding [illegible] 5's were [illegible]

[illegible]

32. Sept. 1, 1865, the interest-bearing debt of the United States was as follows: 4 per cents., $618,127.98; 5 per cents., $269,175,727.65; 6 per cents., $1,281,736,439.33; $7\frac{3}{10}$ per cents., $830,000.00. What was the total annual interest charge?

33. The interest-bearing debt of the United States was as follows, Jan. 1, 1881: 6's, $202,266,550; 5's, $469,651,050; 4½'s, $250,000,000; 4's, $739,347,800; 3's, $14,000,000. What was the decrease during the year 1881 in the annual interest charge? (See statement of Jan. 1, 1882, Art. **462.**) What was the interest of the debt for one day ($\frac{1}{365}$ *yr.*) Jan. 1, 1882?

34. The population of the United States and Territories Jan. 1, 1881, was 50,152,554, and the public debt was $1,899,181,735. What was the debt per capita? What was the average monthly decrease of the debt during the year 1881? (See statement, Art. **462.**)

35. The interest-bearing debt of the United States was as follows, Dec. 1, 1881: Continued 6's (3½'s) (**464**), $159,452,500, last interest paid July 1; continued 5's (3½'s) (**465**), $401,504,900, last interest paid Nov. 1; 4½'s (**466**), $250,000,000, last interest paid Sept. 1; 4's (**467**), $739,347,800, last interest paid Oct. 1; navy pension fund (3's), $14,000,000, last interest paid July 1. What was the aggregate of the interest-bearing debt, and the accrued interest, Dec. 1, 1881?

36. The gross earnings (including the Omaha bridge) of the Union Pacific Railway Co. for 1879, were $13,201,077.66; the operating expenses (including taxes) were $5,475,503.44. What were the surplus earnings, and what per cent. of the gross earnings were the operating expenses?

37. A synopsis of the report of the N. Y. C. & H. R. R. R. for its fiscal year ended Sept. 30, 1881, is as follows: Gross earnings from passengers, $6,958,038; from freight, $20,736,749; from miscellaneous, $4,653,608; expenses, $19,464,786; interest, rentals, and taxes, $4,990,783. What was the surplus for the year after the declaration of a dividend of 8% on a capital stock of $89,229,300? The expenses were what per cent. of the total earnings?

38. The L. S. & M. S. Railway reported as follows for the year ended Dec. 31, 1880: Gross earnings, $18,749,461; operating expenses and taxes, $10,418,105; interest, rentals, dividend on guaranteed stock, and $250,000 for the sinking fund, $3,000,374.

[illegible] a dividend of [illegible], there was a surplus for the year of [illegible]. What was the amount of the dividend, and the capital [illegible]

[illegible] earnings of the M. [illegible] R. R. for the year ended [illegible] operating expenses and taxes, [illegible] rentals $[illegible]. After declaring a [illegible] $[illegible]. What was the rate of [illegible] was $15,778,[illegible]? For [illegible] same stock, what [illegible]

[illegible] considered [illegible] the market [illegible] the value of the [illegible]

[illegible] amount of stock of [illegible] was organized [illegible] share of the [illegible] new stock, and the [illegible] shares of the [illegible] new company, and [illegible]

[illegible] R. R. [illegible] R. R. [illegible]

[illegible] R. R. divided among [illegible] R. R. [illegible] an amount equal [illegible] preceding year. [illegible] 1881. [illegible] 1882? [illegible] shares [illegible] dividend [illegible] and [illegible]

[illegible] annual [illegible] is in- [illegible] invested?

Analysis.—Since dividends are reckoned on the par value of the stock, the dividend on 1 share of $100 would be $6. Since each share costs $120, and pays $6 income, the per cent. will be $6÷$120, or 5%.

Note.—The above analysis will not apply to bonds that mature at a certain fixed time, unless the investor expects to sell the bonds before maturity at the cost price. If 6% bonds that mature in 1891 are purchased in 1881 at 120, and are sold at the same rate before maturity, they will pay 5% on the investment, or cost. If the bonds are held until maturity (1891), or for 10 years, the owner would receive from the government the par value only, or $100 for a bond of that amount, and the bonds would yield less than 5%. If 6% bonds, maturing in 10 years, are purchased at $1.07\frac{72}{100}$ and held until maturity, they will pay 5% on the investment (See Ex. 64). If 6% bonds, that mature in 2 years, are purchased at more than 112, there would be a loss of interest to the purchaser instead of a gain.

46. Which is the better investment, stock paying a regular annual dividend of 5% and bought at 80, or stock paying 8% dividends and bought at 120?

47. If insurance stock paying regular dividends of 10% annually is bought at 137¼, brokerage ¼%, what per cent. of income will it produce?

48. Which investment will produce the greater annual income and how much, $20,000 invested in Chemical Bank stock at 2000 which pays dividends of 15% every 2 months, or the same amount invested in Chatham Bank stock at 125 which pays regular semi-annual dividends of 3%?

49. What rate can you afford to pay for stock paying regular annual dividends of 10%, in order to realize 6% on the investment?

50. At what price must 8% stocks be purchased to afford 5% on the investment? To afford 6%?

51. Stocks bought at 80 pay regular dividends of 5%. What is the rate per cent. on the investment? At what rate should they be purchased to afford 4% on the investment? To afford 8%?

52. I sell 200 sh. H. & St. J. pf. at 111⅜, and $10000 N. Y. Elevated 1st mortgage bonds at 119. What will be the net proceeds of the sale, allowing usual brokerage?

53. Purchased 400 shares Lake Shore at 118½, and 200 shares Chesapeake and Ohio 2d pref., at 24⅜. Sold the Lake Shore at 113⅝, and the Chesapeake and Ohio at 22¾. What was the loss, usual brokerage, no interest?

[illegible] July 20, a broker received from a customer a remittance of $1000 as a margin [illegible] and purchased for him 100 shares of St. Paul Common at 60. On Aug. 2, the broker sold the stock at [illegible]. What was the customer's profit?

[illegible]

	Dr.			
July 20	To 100 shares St. Paul Com. 60	[illegible]		
	Commission ⅛ %	12.50	[illegible]	
Aug. 2	Interest [illegible] [illegible] days		[illegible]	[illegible]
	Cr.			
July 20	By margin deposited		[illegible]	
Aug. 2	" 100 shares St. Paul Com. 64[illegible]	[illegible]		
	Commission ⅛ %	12.50	[illegible]	
Aug. 2	Interest $1000 [illegible] days		[illegible]	[illegible]
	Balance			[illegible]

The profit is equal to this balance less $1000, the original deposit.

[illegible] Aug. 30, a broker purchased for the account of a customer 800 shares Northwestern Railroad stock at 78. He deposited as a margin $4000. On Sept. 22, the stock was sold at 74¼. What was the loss? (Interest 6%, usual commission.)

[illegible] May 10, a speculator deposited with his broker $5000 as a margin, and directed him to purchase for his account 500 shares N. Y., L. E. & W., pref. at 90¼. May 20, the stock was sold at 94¼. What was the gain, interest 6%, usual brokerage?

[illegible] Sept. 10, I deposited with my broker $5000 as a margin, and he purchased for me 300 sh. Cen. Pac. at 90¼, 200 sh. Morris & Essex (half stock) at 122¼, 200 sh. Tex. & Pac. at 49¾. The stocks on Sept. 30 were quoted as follows: Cen. Pac. 80¾, Morris & Essex [illegible], Tex. & Pac. [illegible]. How much should I have deposited with my broker to make my margin of 10% good, and [illegible] and interest? If I [illegible] deposit, and the broker [illegible] my loss?

[illegible] decline in value. [illegible] and at the [illegible]. The broker [illegible] shares at 50, and [illegible] declined to 45, he ordered the broker to "cover his short sale" (buy the stock for delivery), and return the stock to the party from whom it was borrowed. What was the gain, usual brokerage?

OPERATION.

Cr.		
By margin deposited.	$****.**	
" 100 shares Erie borrowed and sold at 50.	****.**	$****.**
Dr.		
To 100 shares Erie bought and returned at 45.	$****.**	
" commission for selling the stock $\frac{1}{8}$%.	**.**	
" " " buying and returning the stock $\frac{1}{8}$%.	**.**	****.**
" amount to credit.		****.**

The net profit equals the balance less the margin deposited.

NOTE.—There is no interest charged on short sales, but it sometimes happens that a small bonus has to be paid for the use of the borrowed stock.

59. A broker sold "short" for me 400 sh. C. B. & Q., at $135\frac{3}{4}$, and 100 sh. C. R. I. & P., at $132\frac{1}{2}$. My "short" sale on C. B. & Q. was "covered" at $131\frac{1}{8}$, and C. R. I. & P. at $133\frac{3}{4}$. What was my net profit, usual brokerage? (No interest.)

60. Sold Aug. 11, 500 shares Chicago & Alton, s. 3, at $94\frac{1}{2}$, and covered my short sale Aug. 14, at 91. What was my profit, allowing the usual brokerage?

61. June 16, bought a Call (**479**, 1) on 300 shares Michigan Central at 86, for 30 days, for which I paid $300. Called the stock July 6, and sold it in the market the same day at $91\frac{1}{8}$. What was my gain, commission on call $\frac{1}{16}$%, for selling stock $\frac{1}{8}$%, interest 6%?

NOTE.—Calls bear interest at 6% from the date of the contract till the contract is closed, but Puts do not.

62. If, in the preceding example, the stock had not advanced to 86 at any time within 30 days, what would have been the loss? What would have been the result if the stock had been sold July 16 at $87\frac{3}{16}$ and called for delivery? If sold July 1 at $86\frac{1}{2}$?

63. Sept. 18, bought a Put (**479**, 2) on 400 shares C. C. & I. C. at 20, for 30 days, for $400. I purchased the stock at 16 and made my delivery on the Put. What was my gain, commission on Put $\frac{1}{16}$%, on stock $\frac{1}{8}$%? What would have been my loss, if the stock had not fallen below 20? What would have been the result, if the stock were purchased for delivery at $18\frac{7}{8}$? At $19\frac{1}{4}$?

64. At what price may 6% bonds, maturing in 10 years, be purchased, so that the investment will pay 5% ?

NOTE.—Tables have been constructed on various plans, and different methods are used by bankers and financiers, for the solution of problems relating to bond investments; two of which are given below.

ANALYSIS.—1. In the following method, it is presumed that the accruing interest is not reinvested, but that a sufficient part of it is set aside as a sinking fund to make up the amount which was originally paid out as premium.

A $1000 bond in 10 years at 6% would amount to $1600 ($1000 + 10 × $60). $1 in 10 years at 5% would amount to $1.50. To amount to $1600, the principal, or the amount paid for the bond, must be as many times $1 as $1.50 are contained times in $1600, or $1066.66⅔ (106⅔%).

If a $1000 bond is purchased at 106⅔, it will be necessary to set aside as a sinking fund each year $6.66⅔ (⅔%) to make up the premium in 10 years. The annual interest, $60, less $6⅔, the annual sinking fund, is $53⅓, which is 5% of $1066⅔, the cost of the bond or the amount invested.

If the amount set aside as a sinking fund is placed at interest, either simple or compound, 6% bonds, maturing in 10 years and purchased at 106⅔, would pay a little more than 5%.

2. The following method anticipates compound interest throughout; i.e., the interest is immediately reinvested at compound interest.

The holder of a $1000 bond would receive $60 interest annually, and $1000, the face of the bond, in 10 years. If money is worth 5%, the several interests in the 10 years at compound interest would amount to $754.674 ($1 placed at compound interest at the beginning of each year would amount in 9 years to $11.5779 (342). $11.5779 plus $1 of the last interest = $12.5779. $60 would amount to 60 times $12.5779, or $754.674). $1000, the principal, plus $754.674, the compound amount of the interest, equals $1754.674, the total value of the bond at maturity, money being worth 5%. The present worth of $1754.64, due in 10 years, at 5% compound interest, is $1754.64 ÷ $1.6289 (341), or $1077.19. Hence the bonds must be purchased at $1.07\frac{19}{100}$ to pay 5% on the investment. See Ex. 45, Note.

65. What must I pay for 6% bonds, maturing in 15 years, that my investment may yield 3½% ? (Both methods.)

66. 6% bonds, maturing in 10 years and bought at 106⅔, pay what per cent. on the investment? (See 1st analysis, Ex. 64.)

ANALYSIS.—A $1000 bond would amount in 10 years at 6% to $1600. If $1066.66⅔ is paid for the bond, the net interest for 10 years is $1600 − $1066.66⅔, or $533.33⅓, and for one year $533.33⅓ ÷ 10, or $53.33⅓. An income of $53.33⅓ on an investment of $1066.66⅔ is equivalent to 5% ($53.33⅓ ÷ $1066.66⅔).

67. What rate of interest do I receive on my investment, if I buy 7% bonds maturing in 20 years at 133⅓?

TAXES.

DEFINITIONS.

482. A **Tax** is a sum of money assessed on persons and property to defray the expenses of a state, county, town, corporation, or district.

1. In certain states all citizens above 21 years of age are required by law to pay a certain tax on the person. This tax is called a *Capitation* or *Poll Tax.*

2. The expenses of states, counties, towns, etc., are paid by a direct tax upon the property or polls of the same. The methods of assessing taxes differ in the several states. In some states, a certain percentage of the whole tax is assessed upon the polls, while in others the poll tax is a fixed amount for each citizen. In certain states, the whole tax is paid by the owners of the property of the same.

3. The expenses of the United States government are paid by duties on imports; the internal revenue (the tax upon distilled spirits, fermented liquors, tobacco, snuff, and cigars, proprietary medicines, perfumery and cosmetics, playing cards, matches, etc.); sales of public lands; tax on circulation, deposits, and capital of national banks; customs fees, fines, penalties, and forfeitures; fees, consular, letters patent, and land; profits on coinage, etc.

The receipts of the United States for the fiscal year ended June 30, 1881, were as follows: Customs (including tonnage dues), $198,159,676; internal revenue, $135,264,385; public lands, $2,201,863; miscellaneous, $25,156,366.

483. **Real Estate** is fixed property; as land, houses, etc.

484. **Personal Property** is movable property, as money, stocks, bonds, mortgages, furniture, merchandise, etc.

485. An **Assessor** is a person appointed or elected to estimate the valuation of all property liable to taxation.

486. A **Collector** or **Receiver** of taxes is a person appointed or elected to collect or receive the taxes of a city, town, village, or district.

Collectors receive a commission on the amount collected or a fixed salary.

EXAMPLES.

487. *1.* For the fiscal year 1879, the N. Y. State tax levy was at the rate $2\frac{863}{1000}$ mills. How much would this rate produce, the valuation of the taxable property being $2,686,140,000 ?

2. The rate of taxation of a certain county was 3¼ mills, and the amount of the tax $40,653.48. What was the valuation of the property?

3. The following were the rates of taxation of New York for state purposes, 1880:—schools, 1.085 mills; general purposes, 1.475 mills; new capitol, .6 mills; canals, .34 mills. What was the total rate of taxation, and how much was raised by a county whose valuation was fixed by the state board of equalization at $11,047,534? How much was raised for school purposes?

4. The state tax of a certain county was $38,666.37, and the valuation of the county, $11,354,880. How much of this tax was paid by a town whose valuation was fixed by the board of supervisors at $3,938,663.17 ?

5. The total county expenses of the same county were $25,063.35. How much should be apportioned to the above town?

6. Taxes were levied in a certain town for the following purposes:—support of poor, $2,000; roads and bridges, $500; accounts audited by town auditors, $2,876.10; accounts audited by supervisors, $19.48; county expenses, $9,774.72 less a surplus of $6,055.90 in the county treasury; state and school tax, $15,079.88; surplus tax, $868.98. What was the rate of taxation, the total valuation of the property, as made by the town assessors, being $4,321,252? What was the tax of Mr. A., whose valuation was $7,300 ?

7. Find from the following table the tax on $16750.

OPERATION.

Tax on $16000 is $92.80
" 750 " 4.35
" 16750 " 97.15

ANALYSIS.—By looking in the table opposite 1 and under 6, we find that the tax on $16 is $.0928, and by removing the point 3 places to the right, we find the tax on $16000 to be $92.80. In the same manner, the tax on $750 is found to be $4.35. The tax on $16750 is $92.80 plus $4.35, or $97.15.

8. How much was paid by Mr. B. on an assessment of $6400, the collector charging a commission of 1% additional? (Use table.)

Note.—To save labor in the calculation of taxes, a table similar to the following is usually prepared by the accountant.

Tax Table.—Rate, 5.8 mills on $1.

	0	1	2	3	4	5	6	7	8	9
1	.0580	.0638	.0696	.0754	.0812	.0870	.0928	.0986	.1044	.1102
2	.1160	.1218	.1276	.1334	.1392	.1450	.1508	.1566	.1624	.1682
3	.1740	.1798	.1856	.1914	.1972	.2030	.2088	.2146	.2204	.2262
4	.2320	.2378	.2436	.2494	.2552	.2610	.2668	.2726	.2784	.2842
5	.2900	.2958	.3016	.3074	.3132	.3190	.3248	.3306	.3364	.3422
6	.3480	.3538	.3596	.3654	.3712	.3770	.3828	.3886	.3944	.4002
7	.4060	.4118	.4176	.4234	.4292	.4350	.4408	.4466	.4524	.4582
8	.4640	.4698	.4756	.4814	.4872	.4930	.4988	.5046	.5104	.5162
9	.5220	.5278	.5336	.5394	.5452	.5510	.5568	.5626	.5684	.5742

9. Mr. D. being delinquent was charged 5% additional. How much was he obliged to pay on a valuation of $9500 ?

10. What was the total tax, including commission of 1%, of Mr. C., whose real estate was assessed at $24000, and personal property at $15500 ?

11. In the City of Brooklyn, N. Y., the following is the law regarding the payment of taxes :

> **On all taxes and assessments which shall be paid to the collector, before the expiration of one month after the warrant for the collection of the same shall have been delivered to him, an allowance shall be made at the rate of $7\frac{3}{10}$% per annum for the unexpired portion thereof. On all taxes or assessments paid after the expiration of one month from the time the same shall have become due and payable, there shall be added to such tax or assessment interest at the rate of 9% per annum.**

According to the above law, how much tax was paid Jan. 16, by Mr. A., the valuation of whose property was $7500, the rate of tax being $2.376 per $100, and the warrant having been delivered to the collector, Jan. 4? How much was paid by Mr. B., on a valuation of $12500, Mar. 26 ? (365 days to the year.)

12. What is the total tax on 8375 pounds tobacco at 16¢, 4360 gallons distilled spirits at 70¢, 2165 barrels beer at $1 ?

13. How much is the semi-annual tax of a national bank whose average circulation is $225,000 at ½%, average deposits $1,416,387 at ¼%, average capital stock $400,000 at ¼% ?

DUTIES.

DEFINITIONS.

488. Duties or **Customs** are taxes assessed by the Government upon imported merchandise for the purpose of revenue for the support of the government and for the protection of home industry.

1. The total ordinary revenues of the United States for the fiscal year ended June 30, 1881, were $360,782,292, of which $198,159,676 were received from customs. Of the latter amount, $138,908,562 were collected at the port of New York, leaving $59,251,114 as the amount collected at all other ports of the country.

2. The waters and shores of the United States are divided into collection districts; in each of which there is a port of entry and one or more ports of delivery. Thus, the district of Boston and Charlestown comprises all the waters and shores within the counties of Middlesex, Suffolk, and Norfolk. Boston (including Chelsea) is the port of entry, and Medford, Cohasset, Hingham, Weymouth, Cambridge, Roxbury, and Dorchester, the ports of delivery. All ports of entry are also ports of delivery.

3. All cargoes chargeable with duties shall be entered and the duties paid, or secured to be paid, at the port of entry, before permission shall be given to discharge the same at the port of delivery.

4. The principal officer of every district is the collector, who is assisted by deputy-collectors, surveyors, appraisers, weighers, gaugers, inspectors, etc. The duties of the above vary in the several collection districts and ports. There is also in the leading ports of entry, a "naval officer," whose department is a check upon that of the collector. He receives copies of all invoices and entries, estimates duties, countersigns permits, clearances, certificates, debentures, and other documents, granted by the collector.

5. The surveyor usually superintends and directs the inspectors, weighers, and gaugers, within his port.

6. An importer desiring a permit to land merchandise, presents his invoice, with the consular certificate, bill of lading, and the formal entry attached (See Ex. 25, Art. **499**), to the entry clerk at the custom-house, and makes the necessary oath before the collector or his deputy. The duties, if

any, are estimated in the departments of the collector and the naval officer. The amount of the estimated duties having been paid, or secured by a bond, the collector, together with the naval officer, where there is one, grants a permit to land the merchandise. It is the custom of custom-house brokers and many merchants to calculate the duties and enter the same on the entry.

The permit is presented to the inspector in charge of the vessel, who allows the merchandise to be landed. The collector indicates on the permit by numbers what packages shall be sent to the public store for examination.

When the merchandise is examined by the appraiser (**495**), he enters on the invoice (**494**) or manifest the rate of duty to be collected. The invoice and the accompanying papers are then sent to liquidators in both the collector's and naval officer's departments for adjustment. The liquidators check the calculations on the entry, or again calculate the duty if the appraiser has changed the rate or the dutiable value, or if the returns of the weigher or gauger differ from the weight or measurement in the invoice. The amount of duty to be refunded or collected is marked on the entry. If the difference between the duty as estimated and as liquidated is less than $1, it is disregarded, and the liquidator approves the original estimate.

489. A Custom-House Broker is a person who makes entries, secures permits, and transacts other business at custom-houses for merchants. He is familiar with the tariff laws and the details and regulations of custom-house business, and usually acts under a power of attorney.

1. The necessary blanks for making entries are provided by the broker, or they may be obtained at any stationer's.

2. The greater part of the business at the New York custom-house is done through brokers.

490. The following are the principal entries made at custom-houses:

1. Import entry of merchandise for immediate consumption.

2. Import entry of merchandise for storage in a bonded warehouse, called a "Warehouse entry." (See Art. **496**.)

3. Import entry of merchandise for immediate transportation in bond (in sealed cars) to another port of entry; as goods landed at New York to be transported in bond to Chicago. In this case the goods are appraised, and the duties assessed and collected at Chicago.

4. Entry of merchandise for immediate transportation in bond to Canada or Mexico, or other foreign country. In this case no duties are collected.

5. Withdrawal entry from bonded warehouse for consumption at the place of importation. (See Art. **496**.)

4. Withdrawal entry from bonded warehouse for immediate transportation in bond to another port of entry.

5. Withdrawal entry from bonded warehouse for immediate transportation in bond to Canada, Mexico, or other foreign country.

6. Export entry of merchandise manufactured in the United States for the benefit of drawback (497).

494. Duties are of two kinds, *ad valorem* and *specific*.

495. An **Ad Valorem Duty** is a tax assessed at a certain per cent on the dutiable value of the merchandise; as [illegible] 25%, [illegible] 30, 35 and 40%, [illegible] 45 and 50%.

The dutiable value of merchandise is its market value at the port of [illegible] the date of invoice [illegible], whether [illegible] charges, excepting the consul's [illegible] The charges include the [illegible] packages and all other charges, except the consul's fee [illegible] transportation from the port of export [illegible] value (494).

[illegible]

496. A **Specific Duty** is a tax assessed at a certain sum per [illegible]

[illegible]

494. An **Invoice** (**277**) is a statement made by the seller or shipper of merchandise giving a description of the same, and showing marks, numbers, quantity, value, charges, and other details. (See Ex. 26, Art. **499**.)

1. All invoices shall be made out in the weights and measures of the country from which the importation is made.

2. All invoices of merchandise subject to a duty ad valorem, shall be made out in the currency of the country or place from whence the importation is made.

3. When the value of the foreign currency is fixed by law (see Art. **192**), the value is to be taken in estimating the duties; when the value is not fixed by law, the invoice must be accompanied by a consular certificate showing its value.

4. All invoices of importations must, before the shipment of the merchandise, be produced to and authenticated by the U. S. consular officer, where there is such an officer. In countries without a U. S. consular officer, the authentication is made by a consul of a country in amity with the United States; or, if there be no such consul, then by two respectable resident merchants.

All invoices must be made in triplicate; the three copies to be regarded as one invoice, and subject to only one charge for consular certificate. One of the triplicate invoices is returned to the person producing them; another is carefully preserved in the office of the consul; and the third is transmitted to the collector of the port of destination of the merchandise.

5. When the value of merchandise imported into the United States shall not exceed $100, the collector is authorized to admit the same to entry, without the triplicate invoice required in other cases.

495. An **Appraiser** is an officer of the customs who examines imported merchandise and determines the dutiable value and the rate of duty of the same.

1. The place where the examinations are usually made is called the "Public Store."

2. One package of every invoice, and one package at least out of every ten similar packages, shall be sent to the public store for examination. Certain bulky and heavy articles are examined at the wharf where unloaded. Weighable and gaugable goods on which the duties are specific, are not sent to the public store for examination.

3. When the appraised value of any merchandise subject to an ad valorem duty is 10% more than the invoice value as entered by the importer, then in addition to the duty imposed by law on the same, there shall be collected 20% of the duty imposed on the same.

496. A **Bonded Warehouse** is a place for the storage of merchandise on which the duties or taxes have not been paid.

1. If an importer does not desire to place his goods at once in the market, or anticipates exporting the same, by giving a bond for the payment of the duties and making the entry in the proper form, he may have the merchandise stored at his own risk in a bonded warehouse, and thus defer the payment of the duties.

2. The importer may select any U. S. bonded warehouse in which to deposit his merchandise.

3. Merchandise may be withdrawn from a bonded warehouse for exportation to Canada or other foreign country, without the payment of the duty on the same.

4. Merchandise is frequently sold "in bond" at prices which do not include the duty.

5. Merchandise that may be in warehouse under bond for more than one year, will be liable when withdrawn for 10% additional duty.

6. Any goods remaining in public store or bonded warehouse beyond three years shall be regarded as abandoned to the government, and sold under certain regulations and the proceeds paid into the Treasury.

[illegible]. Drawback.—When distilled spirits, fermented liquors, medicines, and perfumery, upon which an internal revenue tax has been paid, and foreign merchandise upon which an import duty has been paid, are exported, the tax or duty upon the same is refunded. Such return of the tax or duty is called a **Drawback.**

[illegible]. The **Free List** is a list of articles which are exempt from duty.

In making entries of free goods, the value as given in foreign money must be reduced to U. S. money (See Art. [illegible]), permits must be obtained to land the goods, and certain packages are sent to the public store for examination.

EXAMPLES.

490. 1. A merchant imported from Lyons an invoice of silk, the dutiable value ([illegible]) of which was [illegible] francs. What was the dutiable value of the same in U. S. money, and what was the duty at [illegible] ([illegible])?

[illegible] their values in United [illegible]

[illegible] =

[illegible] per

3. What were the average daily receipts of the New York custom-house for the fiscal year ended June 30, 1881, making allowance for 52 Sundays and 7 holidays. (See Art. **488**, 1.)

4. An invoice of woollen cloth weighing 516 pounds, and valued at £327 16*s*, was imported from England. What was the duty at 50 cts. per pound and 35%?

5. An importer on making his entry at the custom-house, paid the duty on 38716 pounds (Invoice weight) of tobacco, at 35 cts. per pound. According to the return of the custom-house weigher, the net weight was 38472 pounds. How much of the duty was refunded when the entry was liquidated?

6. The duty on 28432 pounds of sugar was paid at the rate of 2¾ cts. per pound. According to the weigher's return, the net weight was 28218 pounds. How much additional duty was collected, the appraiser having fixed the duty at 3¼ cts. per pound?

7. Find the duty on an invoice of linens from Ireland, dutiable value £424 15*s.* 6*d.*, at 35%?

8. What is the duty on an invoice of porcelain vases from Paris at 50%, dutiable value 9843 francs?

9. Find the duty on 475 *cu. ft.* of statuary marble imported from Italy, dutiable value 16425 lire, at $1 per cubic foot, and 25%.

10. What is the duty on 37420 pounds of pig iron at $7 per ton (**493**, 2)?

11. Find the duty on an invoice of leather goods from Vienna, dutiable value 6429 florins, at 35%.

12. What is the duty on an importation of toys from Germany, dutiable value 8437 marks, at 50%?

13. What is the duty at 28 cents per *sq. yd.* and 35%, on 1248 yards of Brussels carpet, 27 *in.* wide, invoiced at 3*s.* 6*d.* per yard, shipping charges (less consul's fee) £2 16*s.* 9*d.*?

14. Find the duty on an importation from Canada of 5284 bushels of potatoes, invoiced at 45 cts. per bushel, and 37475 pounds of hay, invoiced at $1250 per ton (2000 *lbs.*), the duty on potatoes being 15 cts. per bushel, and on hay 20%.

15. On a certain invoice of 34216 pounds of pepper, there are discounts for damage as follows: 12% on 6190 pounds, 8% on 6438 pounds, and 5% on 9642 pounds. After deducting the discount, what would be the duty on the remainder at 5 cents per pound?

16. The duty on burlaps is 30% ad valorem. What is the amount chargeable on a bale containing 50 webs, each being 54 *yds.* and 16 *in.* long, and 27 *in.* wide, and valued at 30 cents per *sq. yd.*?

17. What is the amount of duty chargeable on 2465 pounds of wool, valued at £171 8s., when the rate of duty is 10 cts. per pound and 11% ad valorem?

18. The duty on certain glass plates being 35 cents per *sq. ft.*, find the duty on 316 boxes, each containing 20 plates, and each plate being 24 *in.* by 30 *in.*

19. Find the duty at 25%, on one engraving, cost in London £34 5s., case and shipping charges 15s., commission 2½%.

20. What is the duty at $1 per *cu. ft.* and 25%, on a block of marble 2 × 3 × 7 *ft.*, imported from Italy, dutiable value 3450 lire?

21. Find the duty on 4175 *lbs.* cloves at 5¢ per *lb.*, 476 *lbs.* cinnamon at 20¢, and 5437 *lbs.* rice at 2½¢.

Make the extensions, find the dutiable value, and calculate the duty on the following invoices and accompanying entries:

22. Entry of merchandise, imported by Tefft, Weller & Co., from Berlin in the Str. "Silesia." Arrived Jan. 14, 1882. New York, Jan. 16, 1882.

Marks.	Nos.	Packages and Contents.	60%.
T. W.	351	One case half silk goods, . . .	Rm. 2399.80
		Commission 2½%, . . .	**.
			****.**
		Rm. ****.** @ 23.8¢ =	$***.**
		60% of $*** = $***.	

NOTE.—The following is an entry of free goods. Free goods are entered and the foreign monetary units reduced to U. S. money for statistical purposes in the same manner as dutiable goods.

23. Entry for consumption of merchandise, imported by W. H. SCHIEFFELIN & Co., in the Str. "Ailsa" from Savanilla, on the 10th day of January, 1882. New York, Jan. 12, 1882.

	Free.
33 bales Medicinal Bark, ...	2310.
Packing, ...	12.
Commission 2½%, ...	**.**
(Pesos of U. S. of Columbia), . .	****.**
@ 82.3¢, ...	$****.

24. Invoice of one package merchandise, purchased by GLADHILL & Co. for account of D. BUCKLEY & Co., New York, and forwarded for shipment to D. & C. MACIVER, Liverpool.

		£.	s.	d.
D. B. 207	4 Pieces Drab Cotton Pantaloon 32 *in.* wide, .			
	#1729 79 *yd*, ...			
	30 80, ...			
	31 77½, ...			
	32 79, 315½ (less $\frac{1}{37}$) 307 @ 2s. 2d., . .	**	*	*
	1½% discount, ...		**	
		**	**	*
	Verification and Commissioner's fee, .		14	10
	2½% Commission, ...		16	5
		**	*	*
	Less Consul's Certificate (not dutiable),		14	10
		33	11	7

Entry of merchandise, imported by D. BUCKLEY & Co. in the Str. "Catalonia" from Liverpool. New York, Jan. 12, 1882.

				35%.
D. B.	One case cotton, ...			33–11–7
207	@ 4.8665	=		$***.
	Duty 35% of $***	=	$**.**	

[illegible] Invoice of 700 bales leaf tobacco shipped by F. B. del Rio & Co., per Str. "Niagara" for New York, and consigned to [illegible] de Bary & Co.

[illegible]	700 bales 8?077 lbs. (See Art. 259, Spain)		$35000	
	CHARGES.			
[illegible]	Baling	$525.		
	Export duties	3407.39		
	Consul fee	2.75		
	Small charges	49	*****	**
			******	**
	Commission 2½%		****	**
	Spanish gold		$******	**

Havana, Dec. 27, 188[illegible].

Custom House, New York, Collector's Office, Jan. 4, 1882.

Bond No. [illegible]

Entry of merchandise, imported on the third day of January, 1882, by [illegible] de Bary & Co., in the Str. "Niagara" from Havana.

[illegible]	[illegible]		$	
F. B. [illegible]	700 bales leaf tobacco		[illegible] lbs.	$[illegible].74
				[illegible]
	[illegible]	[illegible]		[illegible]
	[illegible]	[illegible]		
	[illegible]	[illegible]		
	[illegible]			

[illegible]

29. SHEFFIELD, ENGLAND, Dec. 14, 1881.

Mr. A. R. WHITNEY.

Bought of THOS. WIDDOWSON & Co.

			C.	qr.	lbs.		£.	s.	d.
◇ W.	#1	1 Cask Corset Steel 3⅜ × 26, . .	12	3	21				
	#2	1 " " " "	12	0	22				
	#3	1 " " " "	13	0	20				
	#4	1 " " " "	12	2	7				
			**	*	**	25/–	**	**	**
		4 Casks 5/– each, ...					*		
		Carriage to Liverpool 16/8 per ton, .					*	*	*
		Shipping Expenses 2/6 " " .						*	*
		Consul's Fee, ...						10	4
		Commissioner's Fee, ...						4	6
							**	**	*

Entry of Merchandise, imported by A. R. WHITNEY in the Str. "Gallia" from Liverpool. New York, Dec. 30, 1881.

		2¼¢.	
◇ W.	Four Casks Steel,	50 C. 3 *qr.* 14 *lb.*	£67 15s. 6d.
	Less C. C.,		14 10
1/4			67 0 8
	Charges, .		1 13 6
			68 14 2
		@ 4.8665 =	$***
	**** *lbs.* @ 2¼¢=	$***.**	

NOTE.—On all merchandise the growth or produce of the countries east of the Cape of Good Hope (except wool, raw cotton, and raw silk, as reeled from the cocoon, or not further advanced than tram, thrown, or organzine), when imported from countries west of the Cape of Good Hope, there is levied a discriminating duty of 10% ad valorem in addition to the duties imposed on any such articles when imported directly from the place of their growth or production (R. S. 2501). If the following goods, which are on the "Free List" (**498**), had been imported directly from the place of their production, there would have been no duty on the same.

[illegible] [illegible] of fifty-six packages merchandise purchased in London, shipped by Thomas Robinson per Str. "City of Lincoln," for account and risk of and consigned to McKesson & Robbins, New York.

		£	s.	d.
M & R	Gum Arabic.			
[illegible]	cwt. qr. lb. Six cases 8 2 23 net @ £11 16s. . .	***	*	*
	Discount 2½%.	*	**	*
		**	**	*
	Expense.		1	6
		**	**	*
M & R	Coir Fiber.			
[illegible]	cwt. qr. lb. Fifty bales 89 [illegible] net @ 31s. 6d. . .	***	*	
		***	**	*
	Brokerage.	1	4	
		***	*	*
	Charges.			
	£ s. d. Shipping charges, cartage, &c. 3 18 7			
	Consul's certificate 14 10	*	**	*
	London, Dec. 31, 1881.	***	**	*

Port of New York, Jan. 6, 1882.

Entry for Consumption of Merchandise, imported by McKesson & Robbins in the Str. "City of Lincoln," from London on the fourth day of January, 1882.

Marks.	Numbers.	Packages and Contents.	Value.
M & R	1 to 6	Six cases Gum Arabic (Gum [illegible]).	
		cwt. qr. lb. net, 8 2 23 [illegible] [illegible] [illegible]	97.13.8
M & R		Fifty bales Coir Fiber.	
		cwt. qr. lb. net, 89 1 1 [illegible] [illegible] [illegible]	141.10
		Charges [illegible] . . .	3.18.7
			***. *.*

[illegible] @ 4.8665 = $****.

[illegible] 10% on $**** = ***.**

PARTNERSHIP.

DEFINITIONS.

500. Partnership is the association of two or more persons who join their capital and services for the purpose of conducting business, the gains or losses being shared in such proportion as may be stipulated in the agreement.

The business association is called a Firm, House, or Company; and each individual of the association is called a Partner.

501. A **Special Partner** is one who takes no active part in the business, and whose liability is limited to the amount of his investment. In order to thus limit his liability, the amount of his investment must be duly advertised, and he must take no active part in the business.

The partners who conduct the business are called **General Partners.** Their private property is liable for the debts of the partnership.

502. The **Capital** or **Capital Stock** is the money or other property which is invested in a business.

The partners' accounts are used to show the amounts invested.

In most firms, the investments are entered in the partners' "stock accounts," and the amounts withdrawn by the partners during the year and their salaries are entered in their "private accounts."

503. A **Resource** or **Asset** is any kind of property belonging to the concern having a financial value.

504. A **Liability** is a debt owing by the concern.

505. The **Net Worth** of a concern is the excess of its resources over its outside liabilities.

306. The Net Insolvency of a concern is the excess of its outside liabilities over its resources. The concern being unable to pay its debts in full, it is said to be insolvent.

307. Gains or Losses, how shared.—In most partnerships, the gains or the losses are divided according to certain fractions or percentages; the inequalities of the investments are adjusted by allowing interest upon the same; and the partners receive salaries for their services rendered. (See Ex. 34, Art. 310.) Sometimes the net gain or net loss is shared in proportion to the investments (Ex. 15, Art. 310), or the average investments. (Ex. 21, Art. 310.) In joint stock companies the gains (dividends) and the losses (assessments) are shared in proportion to the investment or the amount of stock held.

308. Gains or Losses, how found.—When the books have been kept by "Single entry," and when no books have been kept, the gain is found by subtracting the net worth (305) at commencing, or the investment, from the net worth at closing; and the loss, *vice versa*.

When the books have been kept by "Double entry," the gain may be found as above, or by subtracting the sum of the separate losses from the sum of the separate gains. The results by the two methods should be the same and should prove each other.

EXERCISES.

309. In the following exercises find the gain or the loss:

1. Capital at commencing, $6500; capital at closing, $8000.
2. Capital at commencing, [illegible]; capital at closing, $8000.
3. Capital at commencing, $6500; insolvency at closing, [illegible].
4. Capital at commencing, [illegible]; insolvency at closing, [illegible].
5. Insolvency at commencing, [illegible]; capital at closing, [illegible].
6. Insolvency at commencing, [illegible]; capital at closing, [illegible].

7. Insolvency at commencing, $5000; insolvency at closing, $4000.

8. Insolvency at commencing, $5000; insolvency at closing, $9000.

Find the capital or the insolvency at closing:

9. Capital at commencing, $5000; gain during the year, $3000.

10. Capital at commencing, $5000; gain during the year, $6000.

11. Capital at commencing, $5000; loss during the year, $2000.

12. Capital at commencing, $5000; loss during the year, $8000.

13. Insolvency at commencing, $5000; gain during the year, $1000.

14. Insolvency at commencing, $5000; gain during the year, $7000.

15. Insolvency at commencing, $5000; loss during the year, $4000.

16. Insolvency at commencing, $5000; loss during the year, $9000.

Find the capital or the insolvency at commencing:

17. Capital at closing, $5000; gain during the year, $3000.
18. Capital at closing, $5000; gain during the year, $6000.
19. Capital at closing, $5000; loss during the year, $4000.
20. Capital at closing, $5000; loss during the year, $9000.
21. Insolvency at closing, $5000; gain during the year, $1000.
22. Insolvency at closing, $5000; gain during the year, $8000.
23. Insolvency at closing, $5000; loss during the year, $2000.
24. Insolvency at closing, $5000; loss during the year, $7000.

EXAMPLES.

510. *1.* A and B are partners, A sharing ⅔ of the gain or loss and B ⅓. A invests $5000, and B $2350. At the end of the year their resources and liabilities are as follows: merchandise on hand, per inventory, $2000; real estate, $7000; cash, on hand and

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

$700 [illegible]

[illegible]

[illegible] business [illegible] to the

1. STATEMENT BEFORE ADJUSTING PARTNERS' ACCOUNTS.

RESOURCES.		LIABILITIES.	
Merchandise, . . .	2000	Bills payable, . . .	800
Real estate, . . .	7000	Personal accounts, . .	4471.69
Cash, ...	1532	A's investment, . .	5000
Personal accounts, . .	1640.25	B's do. . .	2350
Bills receivable, . . .	1000		12621.69
	13172.25		
	12621.69		

Excess of resources (net gain), 550.56. A's ⅔, $367.04; B's ⅓, $183.52.

2. STATEMENT AFTER ADJUSTING PARTNERS' ACCOUNTS.

RESOURCES.		LIABILITIES.	
Merchandise, . . .	2000	Bills payable, . . .	800
Real estate, . . .	7000	Personal accounts, . .	4471.69
Cash, ...	1532	A's investment and gain, .	5367.04
Personal accounts, . .	1640.25	B's do.	2533.52
Bills receivable, . . .	1000		
	13172.25		13172.25

2. A and B are partners, A sharing ⅔ of the gain or loss and B ⅓. A invested $5000, and B $2350. During the year the concern gained on merchandise, $955.56; on real estate, $315. The expense account showed a loss of $675; the interest account, $45. What was the net gain, and balance of each partner's account.

NOTE.—The above example is the complement of Ex. 1. The books having been kept by double entry, the separate gains and losses are given, and the net gain thus found. The loss and gain account and the partners' accounts are shown in the following operation in "skeleton ledger" form.

OPERATION.

A.

Balance,	5367	04	Investment,	5000	
			Gain, . .	367	04
	5367	04		5367	04
			Balance, .	5367	04

B.

Balance,	2533	52	Investment,	2350	
			Gain, . .	183	52
	2533	52		2533	52
			Balance, .	2533	52

LOSS AND GAIN.

Expense, . .	675		Mdse., . .	955	56
Interest, . .	45		Real Estate,	315	
A's Gain ⅔, .	367	04			
B's " ⅓, .	183	52			
	1270	56		1270	56

[illegible] Each put into [illegible] were to [illegible] The liabilities were [illegible] How much [illegible] equally?

[illegible] amounts drawn out by the partners [illegible] outside party.

[illegible] business in which I [illegible] separate, and the [illegible] store, $1500; cash on hand [illegible] accounts considered good. [illegible] agreement, I am entitled to ⅗ of the [illegible] during the time of the copartnership [illegible] $4000 and [illegible] $2800. Of the assets given [illegible] entitled to?

[illegible] investing $16000, and each [illegible] resources and liabilities at [illegible] follows, viz.: Merchandise [illegible] hand, $5012.88; personal [illegible] and accepted drafts [illegible] $8000; bonds and [illegible] persons, [illegible] withdrawn [illegible] $1489. What is [illegible]

[illegible] gains and losses [illegible] and [illegible] interest on the same, $150; store fixtures valued at $835; merchandise on hand, $9416; accrued interest on firm's notes outstanding, $112; accrued interest on notes held by the firm, $75. M has withdrawn $2465; and N, $2275. According to the agreement, each partner is to receive a salary of $2500. What are the separate interests at the close of the business?

8. R, S, T, and U enter into copartnership with equal capital, upon the following conditions: R to receive as a salary $2000; S, $1500; T, $1200; and U, $1000; the gain or loss to be divided equally. At the close of the year, the net gain, exclusive of salaries, proves to be $5400. To how much of this amount is each entitled?

9. X, Y, and Z commence business without capital. According to the partnership contract, X is to receive a salary of $3000; Y, $2500; and Z, $2000; the gain or loss to be divided equally. During the year, X withdraws $3000; Y, $2800; and Z, $1800. What is the balance due each partner at the end of the year, if the gain, without taking into account the partners' salaries, is $9000?

10. A and B are partners, A investing ⅔ of the capital, and B ⅓; the gains or losses to be shared in the same proportion. The following is an exhibit of the business, excepting the partners' accounts, at the close of a certain period: *Resources*, cash, $3775; Stone & Co., $150; A. R. Mead, $1200; bills receivable, $5500; interest on the same, $125; merchandise, $5140. *Liabilities*, L. Blair, $500; W. H. Rice, $723; Martens & Bultman, $517.64; bills payable, $3300; interest on the same, $169. The net gain during the year was $3174. What was each partner's original investment?

11. Upon a close valuation of the personal accounts due the firm in the preceding example, the partners are convinced that Stone & Co.'s is worth no more than 50% of its face; and A. R. Mead's, 25% of its face. Upon this valuation what would be the gain, and what the condition of the partners' accounts at closing?

12. P and Q are partners, each to receive interest on his net investment at the rate of 6% per annum, and the net gain or loss to be divided equally. P invests, Jan. 1, $5000; Mar. 1, $4000; June 16, $1500; and draws out Apr. 16, $2500. Q invests, Jan. 1,

$8000; Sept. 16, $2000; and draws out June 1, $1500; Nov. 11, $500. At the close of the year, the net gain is found to be $4475.25, without taking into account the interest on the partners' accounts. What is the amount due each partner after the gain is adjusted? (Time by Compound Subtraction.)

13. A and B have been doing business as partners, A sharing $\frac{3}{5}$ and B $\frac{2}{5}$ of the gains and losses. A invested $4500, average date Mar. 25, 1882; and drew out $2700, average date Sept. 12, 1882. B invested $7200, average date June 17, 1882; and drew out $3750, average date Oct. 25, 1882. At the time of their dissolution, Jan. 1, 1883, the debts of the firm were all paid and they had on hand belonging to the firm $8750 in cash. How shall the money be divided, each being allowed interest at 6% on his investment and charged with interest at the same rate on the amounts drawn? (Time by exact days. Interest 360 days to the year.)

14. A and B are partners, A having $\frac{3}{5}$ and B $\frac{2}{5}$ interest. A advanced in business $12000, average date Jan. 12, 1883; and drew out $1265, average date Oct. 20, 1883. B advanced $7500, average date Apr. 5, 1883; and drew out $2560, average date Nov. 25, 1883. Jan. 1, 1884, A purchases B's interest in the business, and at that date the assets are as follows: Cash, $5800; merchandise, $6250; notes on hand, $7300; accrued interest on the same, $387.14; personal accounts, $5700. The liabilities are as follows: Notes outstanding, $4200; accrued interest on the same, $227.65; personal accounts, $2500. How much is B entitled to, 5% of the personal accounts being considered uncollectible, and interest being reckoned on the partners' accounts at 6% per annum (365 days to the year)?

15. A and B are partners in business, the gain or loss to be divided in proportion to investment. A invested $8750; B invested $4000. The net gain is $2726.15. What is each partner's share?

FIRST OPERATION.—FRACTIONAL METHOD.

ANALYSIS.—Since A's investment, $8750, is $\frac{8750}{12750}$ of the total investment, he is entitled to $\frac{8750}{12750}$ of the gain; and for a similar reason, B is entitled to $\frac{4000}{12750}$ of the gain.

$\frac{8750}{12750} = \frac{35}{51}$; $\frac{35}{51}$ of $2726.15 = $1870.89, A's gain.
$\frac{4000}{12750} = \frac{16}{51}$; $\frac{16}{51}$ of $2726.15 = $855.26, B's gain.

SECOND OPERATION.—BY PROPORTION.

ANALYSIS.—The total investment is to each partner's investment as the total gain is to each partner's gain.

$12750 : $8750 :: $2726.15 : $1870.89, A's gain.
$12750 : $4000 :: $2726.15 : $855.26, B's gain.

NOTE.—Cancel any factor common to the given extreme and either of the means.

THIRD OPERATION.—BY PERCENTAGE.

ANALYSIS.—$2726.15, the gain, is 21.3816% of $12750, the total investment. The partners' gains are therefore 21.3816% of their respective investments.

21.3816% of $8750 = $1870.89, A's gain.
21.3816% of $4000 = $855.26, B's gain.

NOTE.—In order to produce exact results by this method, it is necessary to extend the number expressing the rate per cent. of the gain or loss to several decimal places.

16. E, F, G, and H enter into a joint speculation. E advances $5000, F $7000, G $8000, and H $10000, the gain or loss to be divided according to investment. They gain $14285. What is the share of each?

17. Four merchants ship goods on joint account. A puts in $6000, B $5500, C $4200, and D $4800. What will be each man's share, if the gain is $9200?

18. A lot, whose front is 240 feet and whose depth is 100 feet, is bought by A, B, and C, who pay respectively $3000, $4000, and $5000. How many feet front is each entitled to, if it is divided in proportion to their investments?

19. Five persons having claims against the government, placed their claims in the hands of an agent for collection; A's claim amounted to $500, B's to $425, C's to $300, D's to $250, and E's to $175; but, after the agent had deducted his fees, there remained only $1237.50. How much did each claimant receive?

20. A and B are partners. They have cash and notes on hand to the amount of $6475.28. A has drawn from the concern $2478.30, and B has drawn $1016.48. A invested $4287.46, and B, $1037.75. The firm owe sundry persons $5016.82. What is each partner's present interest in the concern, if they share equally in gains and losses?

21. A and B are partners, gain or loss to be divided in proportion to average investment. A invests, Jan. 1, $4000; Mar. 1, $2000; Oct. 1, $3000; and withdraws July 1, $1500; Dec. 1, $1000. B invests, Jan. 1, $6000; Sept. 1, $3000. They close their books Jan. 1 of the following year and find they have gained $3456. What is each partner's share?

NOTE.—An *Average Investment* is an investment for a certain period of time equivalent to several investments for different periods of time.

OPERATION.

A invested	Jan. 1,	$4000	×	12	=	$48000	
"	Mar. 1,	2000	×	10	=	20000	
"	Oct. 1,	3000	×	3	=	9000	77000
A withdrew	July 1,	1500	×	6	=	9000	
"	Dec. 1,	1000	×	1	=	1000	10000
A's average investment for 1 month,							67000

OR,

A invested	Jan. 1,	$4000	×	2	=	$8000
"	Mar. 1,	2000				
	.	6000	×	4	=	24000
withdrew	July 1	1500				
		4500	×	3	=	13500
invested	Oct. 1,	3000				
		7500	×	2	=	15000
withdrew	Dec. 1,	1000				
		6500	×	1	=	6500
A's average investment for 1 month,						$67000

ANALYSIS.—By the first operation, we suppose each investment to be made for the remainder of the time. To find the average investment, multiply each investment and withdrawal by the interval between its date and time of settlement. Subtract the products obtained from the withdrawals from the products obtained from the investments. The remainder will be the average investment for 1 month, if the time is found in months. A's investment of Jan. 1 is in the business 12 months (Jan. 1 to Jan. 1); the use of $4000 for 12 months is equivalent to the use of $48000 for 1 month. Treating the other investments in like manner, we find A's total investments are equivalent to $77000 for 1 month. A's withdrawals are equivalent to $10000 for 1 month. A's net average investment is therefore equivalent to $67000 for 1 month.

By the second operation, we find the actual amount in the business for each month of the year. Jan. 1, A invested $4000, which was in the business until Mar. 1, or for 2 months. Mar. 1, he added $2000, making his total investment $6000, which was in the business until July 1, or for 4 months. July 1, he withdrew $1500, leaving in the business $4500 until Oct. 1, or 3 months, etc. The several net investments as found in this manner are equivalent to $67000 for 1 month.

B's average investment, as found by either of the above methods, is $84000 for 1 month.

A's average investment for the year is $5583.33⅓; and B's, $7000. To avoid fractions, divide the gain in proportion to the average investments for 1 month. After the average investments are found for a common time, the gain may be divided according to either of the methods under Ex. 15. By the fractional method, A would be entitled to $\frac{67}{151}$ of the gain, and B to $\frac{84}{151}$.

22. C and D are partners, gain or loss to be divided in proportion to average investment. C puts in $6000 for one year, and $7000 for one and a half years; D puts in $6000 for two and a half years. The net loss is $1565.40. What is each one's share?

23. A, B, and C are partners. A puts into the concern $3000, but withdraws half of it at the end of 6 months; B puts in $2000, and adds $500 to it at the end of 4 months; C puts in $2500 for the whole year. The gain during the year is $1700. What is each one's share?

24. Three contractors agree to build a road for $10000. A has 25 men at work for 16 days and 30 men for 34 days. B has 40 men for 10 days and 45 men for 40 days. C has 48 men for 50 days. C receives $200 extra for superintending the work. How much is each contractor entitled to?

25. J, K, and L are partners, gain or loss to be divided according to average investment. J invests as follows: Jan. 1, $6000; Apr. 1, $4000; K invests, Jan. 1, $8000; L invests, Jan. 1, $7000; Apr. 16, $2500; and draws out June 16, $3500. At the end of the year the net gain is found to be $4135.60. What is each partner's share? (Time by Compound Subtraction.)

26. A, B, C, and D were partners for two years. When the firm commenced business, A's investment was $6000, B's $3500, C's $2800, and D's 1700. At the end of 8 months, A withdrew $3000. At the end of 10 months, D added $1300 to his former investment. At the end of one year, B withdrew $800. At the close of the two years, they had gained $4727. What was each partner's share of the gain?

27. A and B are partners for one year, the gain or loss being divided in proportion to their average investments. A invested, Jan. 1, $8000; June 16, $1500; Aug. 1, $2500; and drew out

[illegible] Jan. 1, $1000; Apr. 1, $500; and
[illegible] how much should A invest Sept. 1 to
[illegible]

[illegible] partnership under the following con-
[illegible] and to receive therefor
[illegible] credited as July 1. He
[illegible] and to pay interest on sums with-
[illegible] B and C are to furnish the
[illegible] at the rate of 6% per
[illegible] equally. B invests
[illegible] Jan. 1, $10000; July 1,
[illegible] draws out, Feb. 1, $200;
[illegible] Nov. 21, $100. At
[illegible] account either
[illegible] partners' accounts—
[illegible] partner's account.
[illegible]

[illegible] agreement C is to
[illegible] of the year. D
[illegible] entitled to a
[illegible] accounts after
[illegible] $[illegible]; C's
[illegible]

[illegible] interest and B
[illegible] B agree
[illegible] pays in

[illegible] capital. B
[illegible]

etc. is $1727. During the year M's purchases for the mill amount to $19275. S has received for cash sales $16337, of which he has paid over to M $15550. The sales on account, as shown on M's books, amount to $8375; and the value of the products on hand is $2828. During the year S has purchased goods at M's store to the amount of $837.65. How much is owing to S at the expiration of the year?

33. A and B form a copartnership Jan. 1, 1878, A having $\frac{1}{4}$ interest and B $\frac{3}{4}$. For the purpose of a valuation to be covered by insurance, the inventory of merchandise is increased at the end of the first year $1550. Jan. 1, 1879, the terms of copartnership are changed, A having $\frac{1}{3}$ interest and B $\frac{2}{3}$. At the end of this year, the inventory is increased fictitiously $700 more, or $2250 in all. The same basis of copartnership continues for the year 1880, at the close of which year the inventory is additionally increased $1293.75. Jan. 1, 1881, the terms of copartnership are readjusted, A having $\frac{4}{10}$, and B $\frac{6}{10}$ interest. At the close of this year the inventory was increased additionally $432.50. Jan. 1, 1882, the copartnership was made equal, each partner holding a half interest. The proposition is now made to so adjust this fictitious valuation that each of the partners shall be properly credited in accordance with the new terms of copartnership. 1. What entry should be made to accomplish this purpose? 2. What entry should be made to cancel the fictitious valuation of merchandise, and place the partners' accounts in the proper condition?

34. A, B, and C are partners, A sharing $\frac{2}{5}$ of the gain or loss, B $\frac{2}{5}$, and C $\frac{1}{5}$. Interest is to be reckoned at the rate of 6% per annum (365 days to the year) on the partners' accounts, and each partner is to receive a salary of $1800, to be credited as July 1. A invested, Jan. 1, $16000; and withdrew during the year $4875, average date, Aug. 21. B invested, Jan. 1, $20000; and withdrew $6224, average date, June 18. C invested, Jan. 1, $5000; and withdrew $2625, average date, July 31. Jan. 1, of the following year, the merchandise account shows a gain of $18437.16; the interest account (not including the interest on the partners' accounts) a gain of $586.38; sundry consignment accounts show a net gain of $1287.14. The expense account (not including the partners' salaries) shows a loss of $3424.75. What is each partner's interest in the business at closing? How will A be affected if each partner's salary is increased to $2500?

35. A and B unite in conducting a summer hotel, on the following basis: 1. Each is to receive interest at the rate of 6% *per annum* on his investment; 2. A is to receive a salary of $1000 and B of $800, for the season; 3. The profit or loss of the general business is to be divided in the proportion of A $\frac{2}{3}$, B $\frac{1}{3}$; the profit or loss of the livery business attached thereto in the proportion of A $\frac{1}{3}$, B $\frac{2}{3}$; the profit or loss of the bathing business in the proportion of A $\frac{1}{2}$, B $\frac{1}{2}$. A invests an average of $10150 for four months, and B an average of $6750 for the same time. At the close of the business the accounts showing loss and gain stand as follows:

Outgo.	HOTEL.	Income.
15150.75		25175.19

Outgo.	LIVERY.	Income.
1592.75		3279.50

Outgo.	BATHING.	Income.
759.12		1275.30

There is besides an item of service amounting to $375, which at the time could not be easily apportioned in the charges, and which, of course, does not appear in the above outgoes. It is agreed that this item, as also the sums severally due the partners for interest and salaries, shall be charged to the several departments of the business in proportion to the net gains. There is, also, an inventory in the livery business amounting to $429.33. How much clear gain from all sources will each partner get out of the business.

36. A, B, and C are equal partners in a mill, each to receive 6% *per annum* interest on his average investment. C is to superintend the business and receive therefor a yearly salary of $3000; B keeps a store at which the operatives trade, and is to pay to A and C 5% on sales to operatives. A negotiates the products of the mill, for which he is allowed 10% on the net profits as existing before his percentage is taken. A's average investment for the year is $9750; B's $5750; C's $5000. Leaving out the interest, salary and percentages, the net gain for the year is $15000. B's sales to operatives amount to $1575. What share of the $15000 is each partner entitled to?

37. A owns a business, the good will of which is estimated at $10000, and the stock on hand at $15000. B and C agree to unite with him on the following conditions: B to invest $25000 cash, and C to devote his entire time to the business, for which he is to receive, in addition to his interest, an annual salary of $1000. The capital is to be kept intact, and no interest to be allowed therefor. The gain or loss to be divided equally between the three partners. At the end of the year the resources, including good will, book accounts, notes, inventories, *etc.*, but not including amounts drawn by the partners, amount to $67000, and the liabilities to outside parties, to $10500. C has drawn out during the year $2500; B, $1575; A, $2000. Of the resources above named there are bad debts not to be counted, amounting to $575. What is the condition of each partner's account?

38. A, B, and C are partners in business, investing as follows: A, $4000; B, $6000; C, $8000. The partners are to share the profits and losses in proportion to their investments. Each is entitled to compensation for services at the rate of $150 per month, payable at the end of each month and not to bear interest. In case that either partner shall draw a greater amount than shall at the time be due him for services, he shall be charged interest upon such overdraft at the rate of 1% per month for the length of time such overdraft continues. At the end of the year B and C purchase the interest of A, and in the payment therefor, it is desired that the remaining members shall so invest that their interests shall be equal. It is mutually agreed that the "good will" of the business shall be valued at $3000 in the final settlement. It is also agreed that a discount of 5% shall be allowed upon all uncollected accounts as a fund to meet bad debts and costs for collecting. A statement of the business previous to closing shows the following results: merchandise, horses, wagon, office fixtures, and cash on hand, $12410; sundry debtors, $17030; sundry creditors, $4050; expense account (not including partners' salaries), $2400; profit on merchandise sold, $15290. A withdrew on account of salary Apr. 1, $450; July 1, $300; Oct. 1, 400. B withdrew Mar. 1, $400; Apr. 1, $150; June 1, 400; Oct. 1, $800; Dec. 1, $500. C withdrew Apr. 1, $600; July 1, $700; Oct. 1, $600; Nov. 1, $200. How much must B and C each invest or pay A, and how should the books of the new firm be opened? (Condensed from "The Book-Keeper.")

NOTE.—B and C, not desiring to have the new books encumbered with the contingent accounts of "good will" and "reserve fund," closed these accounts after a settlement was made with A.

[illegible]

cash, and C to devote his entire time to the business, for which he is to receive, in addition to his interest, an annual salary of $1000. The capital is to be kept intact, and no interest to be allowed therefor. The gain or loss to be divided equally between the three partners. At the end of the year the resources, including good will, book accounts, notes, inventories, *etc.*, but not including amounts drawn by the partners, amount to $67000, and the liabilities to outside parties, to $10500. C has drawn out during the year $2500: B, $1575: A, $2000. Of the resources above named there are bad debts not to be counted, amounting to $575. What is the condition of each partner's account?

38. A, B, and C are partners in business, investing as follows: A, $4000; B, $6000; C, $8000. The partners are to share the profits and losses in proportion to their investments. Each is entitled to compensation for services at the rate of $150 per month, payable at the end of each month and not to bear interest. In case that either partner shall draw a greater amount than shall at the time be due him for services, he shall be charged interest upon such overdraft at the rate of 1% per month for the length of time such overdraft continues. At the end of the year B and C purchase the interest of A, and in the payment therefor, it is desired that the remaining members shall so invest that their interests shall be equal. It is mutually agreed that the "good will" of the business shall be valued at $3000 in the final settlement. It is also agreed that a discount of 5% shall be allowed upon all uncollected accounts as a fund to meet bad debts and costs for collecting. A statement of the business previous to closing shows the following results: merchandise, horses, wagon, office fixtures, and cash on hand, $12410: sundry debtors, $17030; sundry creditors, $4050; expense account (not including partners' salaries), $2400; profit on merchandise sold, $15290. A withdrew on account of salary Apr. 1, $450; July 1, $300; Oct. 1, 400. B withdrew Mar. 1, $400: Apr. 1, $150; June 1, 400; Oct. 1, $800; Dec. 1, $500. C withdrew Apr. 1, $600; July 1, $700; Oct. 1, $600; Nov. 1, $200. How much must B and C each invest or pay A, and how should the books of the new firm be opened? (Condensed from "The Book-Keeper.")

NOTE.—B and C, not desiring to have the new books encumbered with the contingent accounts of "good will" and "reserve fund," closed these accounts after a settlement was made with A.

NATIONAL BANKS.

DEFINITIONS.

511. A **National Bank** is a bank organized under the laws of, and chartered by, the United States.

1. Associations for the purpose of carrying on the business of banking may be formed by any number of persons, not less in any case than five (R. S. § 5133).

2. No association shall be organized with a less capital than $100,000; except that banks with a capital of not less than $50,000 may, with the approval of the Secretary of the Treasury, be organized in any place the population of which does not exceed 6,000 inhabitants. No association shall be organized in a city the population of which exceeds 50,000 persons with a less capital than $200,000 (R. S. § 5138). The capital stock shall be divided into shares of $100 each.

3. Every national bank, before it shall be authorized to commence business, shall transfer and deliver to the Treasurer of the United States, any U. S. registered bonds bearing interest, to an amount not less than one-third of the capital stock paid in, except that national banks having a capital of $150,000 or less shall not be required to deposit U. S. bonds in excess of one-fourth of their capital stock as security for their circulating notes. (Act of [illegible].)

4. National banks are authorized to discount and negotiate notes, drafts, [illegible] deposits, to buy and sell exchange, coin and bullion; to loan [illegible] and to issue circulating notes. R. S. § 5136.

5. National banks are prohibited from making loans on real estate. R. S. [illegible] that own shares of capital except to secure debts [illegible] R. S. § 5201.

6. [illegible] mortgages to secure a pre-existing debt [illegible] than five years. R. S. § 5137.

7. [illegible] prohibited from making loans to one person or association, [illegible] value as security. [illegible] R. S. § 5200.

8. [illegible] national bank [illegible] equally [illegible] equal to the par value of the capital stock [illegible].

512. Circulation. Upon a deposit of registered bonds, the association making the same shall be entitled to receive from the Comptroller of the Currency circulating notes of different denominations (**190**), in blank, equal in amount to ninety per centum of the current market value not exceeding par, of the United States bonds so transferred and delivered, and at no time shall the total amount of such notes issued to any such association exceed ninety per centum of the amount at such time actually paid in of its capital stock.

1. Any national bank desiring to decrease its circulation, in whole or in part, may deposit lawful money (specie or legal tenders) with the Treasurer of the United States in sums of not less than $9,000, and withdraw a proportionate amount of bonds held as security for such notes.

No national bank which makes any deposit of lawful money in order to withdraw its circulating notes, shall be entitled to receive any increase of its circulation for the period of six months from the time it made such deposit. Not more than $3,000,000 shall be deposited during any calendar month for this purpose. (Act of July 12, 1882.)

2. The State bank circulation wholly ceased after Congress had imposed a penalty of 10% in the form of a tax every time it should be issued. This act took effect Aug. 1, 1866.

513. Redemption.—The circulating notes of national banks are redeemed in lawful money by the banks which issued them and by the Treasurer of the United States at Washington, D. C.

1. Section 3 of the act of June 20, 1874, provides that every national bank shall, at all times, keep and have on deposit in the Treasury of the United States in lawful money of the United States, a sum equal to 5% of its circulation, to be held and used for the redemption of such circulation.

2. "Section 5222 of the Revised Statutes requires that all national banks which go into voluntary liquidation shall, within six months thereafter, deposit in the Treasury an amount of lawful money equal to the amount of their circulating notes outstanding. The law also requires that full provision shall be made for the redemption of the circulating notes of any insolvent bank before a dividend is made to its creditors. Thus it will be seen that no association can close up its business without first providing for the payment of all its circulating notes, and that the amount deposited for their redemption must remain in the Treasury until the last outstanding note shall have been presented. It is therefore plain that the government, and not the bank, receives all the benefit arising from lost or unredeemed circulating notes."

514. Official Report of a National Bank.

REPORT OF THE CONDITION OF "THE MERCHANTS' NATIONAL BANK," at New York, in the State of New York, at the close of business on the 11th day of March, 1881:

RESOURCES.

Loans and discounts		$6,443,761 75
Overdrafts		2,417 71
U. S. bonds to secure circulation (par value)		400,000 00
U. S. bonds on hand (par value)		95,000 00
Other stocks, bonds, etc		9,000 00
Due from other National banks		265,104 90
Due from State and private banks and bankers		158,515 75
Banking house	$181,000 00	
Other real estate	25,000 00	206,000 00
Current expenses and taxes paid		15,748 72
Premiums paid		14,187 50
Checks and other cash items		87,440 57
Exchanges for Clearing House (**546**)		3,987,982 71
Bills of other banks		45,418 00
Fractional paper currency, nickels, and cents		970 00
Specie, viz.: Gold coin	$280,578 39	
Gold Clearing House Certificates (**547**, 15)	730,000 00	
Silver coin	4,217 60	1,014,795 99
Legal tender notes (**189**)		796,192 00
Redemption fund with U. S. Treasurer (5% of circulation) (**513**, 1)		18,000 00
Total		$13,560,535 60

LIABILITIES.

Capital stock paid in		$2,000,000 00
Surplus fund		389,850 91
Undivided profits		346,361 55
National bank notes outstanding		360,000 00
State bank circulation outstanding		2,689 00
Dividends unpaid		3,320 25
Individual deposits subject to check	$5,417,189 10	
Demand certificates of deposit	6,124 36	
Certified checks	1,567,905 28	
Cashier's checks outstanding	280,699 59	7,271,918 33
Due to other National banks		2,543,987 11
Due to State and private banks and bankers		642,408 45
Total		$13,560,535 60

515. Reserve.—The national banks in the reserve cities* are required by law to hold a lawful money reserve of 25% of their deposits; all other national banks 15%. The excess above legal requirements is called "surplus reserve."

The reserve is made up of specie, legal-tender notes (**189**), U. S. certificates of deposit, balances due from reserve agents, and the 5% redemption fund, with the U. S. Treasurer (**513**, 1).

516. Surplus Fund.—The law provides that a surplus fund shall be accumulated, by setting aside, before the usual semi-annual dividend is declared, one-tenth part of the net profits of the bank for the preceding half-year, until the surplus fund shall amount to 20% of its capital stock.

517. Taxation.—The national banks pay to the United States a tax of 1% annually upon the average amount of their notes in circulation, ½% annually upon the average amount of their deposits, and ½% annually upon the average amount of capital not invested in U. S. bonds.

The banks, other than national, pay taxes to the United States on account of their circulation, deposits, and capital, at the same rates as are paid by the national banks.

EXAMPLES.

518. *1.* Oct. 2, 1879, the number of notes held by the national banks was 808,269, and the total amount $875,013,107. What was the average amount of each note discounted?

2. The impairment of the capital stock ($300000) of an insolvent national bank was $216000. What was the rate per cent. of the assessment made upon the stockholders for the purpose of making good the deficiency (**511**, 6)? How much was Mr. A. obliged to pay, who owned 80 shares?

3. What amount of bank notes is issued to a national bank that deposits $780000 in U. S. bonds to secure circulation (**512**)? How much is its redemption fund (**513**, 1)?

4. A national bank, desiring to reduce its circulation, deposits with the Treasurer of the United States $27000 in legal-tenders, and sells the bonds withdrawn (**512**, 2) in the market at 118¾. What were the proceeds ?

---

* The reserve cities are New York, Boston, Philadelphia, Baltimore, Albany, Pittsburgh, Washington, New Orleans, Louisville, Cincinnati, Cleveland, Chicago, Detroit, Milwaukee, Saint Louis, and San Francisco.

5. The circulation of a national bank having a capital of $150000 is $57600 ; what is the remaining amount of circulation which it may call for by depositing the necessary amount of bonds (**512**)? What is the par value of the bonds now on deposit? What additional amount of bonds will the bank be required to deposit if the circulation is increased to the maximum ?

6. How much is the redemption fund of a bank whose circulation is $427500? What is the amount of bonds on deposit to secure its circulation?

7. The New York associated banks, according to the statement of Saturday, Mar. 25, 1882, held $58,602,100 in specie and $16,150,900 in legal-tenders. Their deposits on the same date were $285,659,600. What was the excess of reserve (**515**) above legal requirements?

8. Oct. 1, 1881, the national banks of Boston had $8,286,182 in specie, $3,457,379 in legal-tenders, $75,000 in U. S. certificates of deposit, $11,735,499 due from reserve agents, and a redemption fund with U. S. Treasurer of $1,603,628. What was the ratio of the reserve to the deposits, which were $95,776,386 ? What amount of reserve was required? What was the surplus reserve ?

9. What amount of reserve was required by the national banks of the State of Maine, their deposits being $9,558,878 ?

10. The net earnings of a bank, whose surplus (**516**) is less than 20% of its capital ($300000), are $10475.38. What amount must be carried to the surplus account, and what are the undivided profits after declaring a dividend of 3%?

11. What is the semi-annual tax (**517**) upon a banker whose capital is $5358, and whose average deposits are $18368 ?

12. What is the semi-annual tax upon a national bank whose average circulation is $462,730, average deposits $1,185,952, capital $1,500,000 ?

13. A bank having a capital of $250,000, and a surplus of $50,000, for a period of six months, earned $58693, and declared a dividend of $30000. What was the rate of the dividend ? The dividend is what % of the capital and surplus ? The net earnings are what % of the capital and surplus ?

SAVINGS BANKS.

DEFINITIONS.

519. Savings Banks are institutions for the deposit and safe keeping of small sums of money. They are designed to encourage thrift and economy among the working classes.

520. Interest is usually declared Jan. 1st and July 1st of each year, and when declared is carried at once to the credit of each depositor on the books of the bank, where it stands as a deposit, and is entitled to interest the same as any other deposit. Savings banks, therefore, pay compound interest.

No interest is allowed on the fractional parts of a dollar, nor is any interest allowed on any sum withdrawn previous to the first day of January or July, for the period which may have elapsed since the last dividend.

521. Deposits are practically payable on demand, though the right to require a notice of 60 or 90 days is reserved.

In some savings banks, deposits commence to draw interest Jan. 1st, April 1st, July 1st, and Oct. 1st; in others, deposits made on or before the first of any month draw interest from the first days of those months respectively.

522. According to the laws of the State of New York,

No person shall have a deposit larger than the sum of three thousand dollars, exclusive of accrued interest, unless such deposit was made prior to the passage of the act (May 17, 1875), or pursuant to the order of a court of record, or of a surrogate.

Savings banks are restricted to 5% per annum regular interest or dividend. They must, however, declare an extra dividend at least once in three years, when their surplus earnings amount to 15% of their deposits.

Savings banks are allowed to pay interest on all sums deposited during the first ten days of January and July, and the first three days of April and October from the first of those months respectively.

EXAMPLES.

523. Perform the following examples according to both methods mentioned in Art. **521**. Where no rate is mentioned, 4% is understood.

1. Mr. A. deposited in a savings bank, Jan. 1, 1882, $145. How much interest should be credited to him July 1, 1882 ?

OPERATION.

$$\begin{array}{r} 145 \\ .02 \\ \hline 2.90 \end{array}$$

ANALYSIS.—In any savings bank, he would be credited for the interest of $145 from Jan. 1 to July 1, or 6 *mo.* at 4% *per annum.* 4% per annum is equivalent to 2% for 6 *mo.*

2. Mr. B. deposited in a savings bank Mar. 29, 1880, $220. How much interest, at 5%, should be credited to him July 1, 1880 ? *Ans.* $2.75.

OPERATION.

$$\begin{array}{r|l} 2 & 20 = 1\%. \\ & \underline{55} = \tfrac{1}{4}\%. \\ \hline 2 & 75 = 1\tfrac{1}{4}\%. \end{array}$$

ANALYSIS.—He is entitled to the interest of $220 from Apr. 1 to July 1, or 3 *mo.*, at 5% *per annum.* 5% per annum is equivalent to 1¼% for 3 *mo.* 1¼% is found as in the operation.

3. A person deposited Dec. 30, 1881, $150; Feb. 20, 1882, $40; April 1, 1882, $120; May 30, 1882, $60. What amount was due July 1, 1882, nothing having been withdrawn ?

ANALYSIS.—If interest begin on the first of each quarter, the first deposit, $150, will draw interest from Jan. 1, or for 6 *mo.*; the second and third deposits, $160, will draw interest from April 1, or for 3 *mo.*; the last deposit, made May 30, will draw no interest July 1.

If interest begin on the first of each month, the first deposit, $150, will draw interest from Jan. 1, or for 6 *mo.*; the second deposit, $40, made Feb. 20, will draw interest from March 1, or for 4 *mo.*; the third deposit, $120, made April 1, will draw interest from April 1, or 3 *mo.*; the fourth deposit, $160, made May 30, will draw interest from June 1, or for 1 *mo.*

4. The following deposits were made in a savings bank: July 1, 1881, $100; July 16, $40; Aug. 1, $75; Aug. 29, $45; Sept. 30, $75; Oct. 28, $200; Nov. 25, $30; Dec. 31, $100. What was due Jan. 1, 1882 ?

5. How much interest was due on the following account July 1, 1883 ? Deposits, Oct. 1, 1881, $200; Dec. 31, 1881, $160; Mar. 24, 1883, $100.

6. Mr. A. made the following deposits in a savings bank: Jan. 1, 1879, $100; May 1, 1879, $140; June 30, 1879, $40; Oct. 1, 1879, $60; Feb. 28, 1880, $120; June 30, 1880, $45; Aug. 29, 1881, $200. What was the balance due Jan. 1, 1882?

7. What is the balance of the following account July 1, 1879, interest being reckoned at 6% until July 1, 1877, and at 5% thereafter: Deposits, Oct. 14, 1876, $200; Mar. 30, 1878, $135; April 1, 1879, $90.

8. How much is due on the following account July 1, 1879, interest being reckoned at 6% until Jan. 1, 1877, and at 5% thereafter: Deposits, Jan. 31, 1876, $100; Apr. 1, 1876, $100; Oct. 28, 1878, $30; Nov. 30, 1878, $30; Feb. 1, 1879, $25; Mar. 1, 1879, $25.

9. What is the balance of the following account July 1, 1882? Balance due Jan. 1, 1882, $103. Deposits, Jan. 28, $40; Mar. 30, $125; May 26, $80. Drafts, Feb. 20, $20; April 18, $15; May 3, $25; June 16, $100.

Analysis.—In order to more readily determine the amounts that are entitled to interest, arrange the account in the following form, and find the balance after each draft or after two or more drafts made without any intermediate deposit.

Date.	Deposits.	Drafts.	Balances.
Jan. 1,	103		
" 28,	40		
Feb. 20,		20	123
Mar. 30,	125		
Apr. 18,		15	
May 3,		25	208
" 26,	80		
June 16,		100	188

The smallest balance found is $123, the amount remaining on deposit after the draft of Feb. 20; of this balance, $103 was on deposit Jan. 1, and the remaining $20 was deposited Jan. 28. (It is the custom to deduct the drafts from the last deposits made). Since the balance June 16, $188, is less than the balance, May 3, $208, it is evident that the excess, $20, has been withdrawn, and therefore is not entitled to interest. Of the $188, interest has already been allowed on $123, and the remaining $65, it is seen by inspection, was deposited Mar. 30.

If interest commence the first of each quarter, the several amounts will

draw interest as follows: $103 from Jan. 1, or 6 months; $20, deposited Jan. 28, and $65 deposited Mar. 30, making $85 from April 1, or 3 months.

If interest commence the first of each month, the several amounts will draw interest as follows: $103 from Jan. 1, or 6 months; $20, deposited Jan. 28, from Feb. 1, or 5 months; $65, deposited Mar. 30, from April 1, or 3 months.

10. What is the balance of the following account July 1? Balance due Jan. 1, $30; deposits, Feb. 16, $50; Apr. 1, $185. Drafts, Mar. 12, $60; May 10, $50; June 20, $60.

11. Find the balance of the following account, Jan. 1, 1883. Deposits, July 1, 1882, $175; Aug. 1, $40; Sept. 16, $280. Drafts, Oct. 18, $90; Nov. 27, $125.

12. Balance the following account, Jan. 1, 1882. Deposits, July 28, 1881, $100; Aug. 16, 1881, $75; Oct. 17, 1881, $50; Oct. 30, 1881, $20. Drafts, Sept. 30, 1881, $25; Nov. 30, 1881, $100.

13. Balance the following Jan. 1, 1881. Balance due July 1, 1880, $300. Deposits received, Aug. 1, $150; Sept. 27, $60; Oct. 12, $325. Drafts paid, July 16, $150; Sept. 1, $150; Nov. 17, $70; Dec. 18, $140.

14. What is the balance of the following account July 1, 1882? Balance due Jan. 1, 1882, $364.48. Deposits, Jan. 24, 1882, $50; Feb. 16, 1882, $80; Apr. 30, 1882, $40; June 28, 1882, $100. Drafts, Mar. 30, 1882, $75; May 19, 1882, $10.

15. How much is due on the following account Jan. 1, 1882? Deposits, Dec. 16, 1880, $300; Feb. 25, 1881, $100; Mar. 16, 1881, $40; July 1, 1881, $25; Sept. 24, 1881, $50; Dec. 30, 1881, $100. Drafts, June 18, 1881, $75; Nov. 13, 1881, $30.

16. What is the balance of the following account July 1, 1882? Deposits, Jan. 3 (as Jan. 1), 1881, $500; Mar. 30, 1881, $90; Oct. 1, 1881, $160; Feb. 20, 1882, $80; Mar. 28, 1882, $40. Drafts, July 20, 1881, $100; Jan. 2 (as Jan. 1), 1882, $40; June 1, 1882, $60.

17. How much was due July 1, 1882, on the following pass-book?

Dr. FRANKLIN SAVINGS BANK in account with F. G. SNOOK. *Cr.*

1881.				1881.		
Jan. 1	Four Hundred Dollars.	400		Aug. 1	Two Hundred Dollars.	200
Mar. 15	Ninety Dollars.	90		1882.		
1881.	Interest to July.	*	**	Jan. 16	One Hundred and Sixty Dollars.	160
Sept. 16	Two Hundred Dollars.	200				
1882.	Interest to January.	*	**	June 1	Eighty Dollars.	80
Feb. 27	Two Hundred and Sixty Dollars.	260				
Mar. 8	One Hundred Dollars.	100				

LIFE INSURANCE.

DEFINITIONS.

524. Life Insurance is a contract by which a company (the insurer), in consideration of certain payments, agrees to pay to the heirs of a person, when he dies, or to himself, if living at a specified age, a certain sum of money.

Life Insurance Companies may be classified according to principles of organization the same as Fire Insurance Companies (**391**).

Of the 31 Life Insurance Companies doing business in the State of New York in 1879, 2 were Stock (**392**), 17 Mixed (**394**) (Stock and Mutual), and 12 purely Mutual (**393**). Their assets Dec. 31, 1879, were $401,515,793 ; surplus as regards policy holders, $65,277,722 ; number of policies in force, 595,486, insuring $1,439,961,163.

Of the companies chartered by the State of New York and doing business in 1879, 10 were Mixed (Stock and Mutual), and 2 were purely Mutual.

525. The principal kinds of policies issued by Life Insurance Companies are the following: **Ordinary Life, Limited Payment Life, Endowment, and Annuity.**

Tontine Investment, Reserve Endowment, Convertible Life, Accelerative Endowment, Yearly Renewable, and other special policies are issued by some companies.

526. Ordinary Life Policies.—On this kind of policy, a certain premium is to be paid every year until the death of the insured, when the policy becomes payable to the persons named in the policy as the beneficiaries.

A policy of this kind gives more insurance, for the same sum of money paid annually, than any other, though it is necessary to continue the payments longer; as according to its terms the payment of the premiums annually continues during the life-time of the insured.

527. [illegible] **Life Policies.**—[illegible] a policy [illegible] a certain number of years [illegible] until the death of the [illegible] the specified period. [illegible] whenever that [illegible]

[illegible] may be made while the insured [illegible] age the policy is [illegible] dividends inform a yearly [illegible] increase the amount insured. [illegible] payments, or with 5, 10, 15, 20, or 25 [illegible]

528. **Term Life Policy** [illegible] agreement to pay to the [illegible] certain sum on his death, provided [illegible] certain fixed term.

529. **Endowment Policies.**—An Endowment Policy provides [illegible] insurance during a stipulated period, payable, like that [illegible] at the death of the insured should he die [illegible] and an endowment of the same amount [illegible] at the end of the period if the insured survive [illegible]

[illegible] the insured the advantage of a limited term [illegible] insurance during the period in which his death [illegible] embarrassment to his family; and if he lives to the stipulated [illegible] the money is paid to him at a time when he may need it.

[illegible] combination of a Term Life Policy and a Pure Endowment.

[illegible] endowment periods of 10, 15, 20, 25, 30, or [illegible] single payment, by annual premiums [illegible] by 5 or 10 annual payments.

530. **Annuity Policies.**—An Annuity Policy secures to the [illegible] of a certain sum of money every year during [illegible] secured by a single cash payment.

531. [illegible] Joint Life Policy is an agreement to pay a certain [illegible] of two or more persons named.

532. The [illegible] of life insurance policies is the present [illegible] paid at death less the present value of [illegible] paid in the future.

533. The **Reserve Fund** of a Life Insurance Company is that sum in hand which, invested at a given rate of interest together with future premiums on existing policies, should be sufficient to meet all obligations as they become due. It is the sum of the separate reserves of the several policies outstanding.

The legal rate for the reserve fund according to the laws of the State of New York, is 4½%; of Massachusetts 4%.

534. A **Non-Forfeiting Policy** is one which does not become void on account of non-payment of premiums.

1. According to the laws of the State of New York, after three full annual premiums have been paid, the legal reserve of the policy, calculated at the date of the failure to make the payments, shall, on surrender of the policy within six months after such lapse, be applied as a single payment at the published rates of the company in either of two ways, at the option of the assured. (1) To the continuance of the full amount of the insurance so long as such single premium will purchase term insurance for that amount, or (2) to the purchase of a non-participating paid-up policy.

2. According to the Massachusetts limited forfeiture law of 1880, after two full annual premiums have been paid, and without any action on the part of the assured, the net value (Massachusetts standard) of the policy less a surrender charge of 8% of the present value of the future premiums which the policy is exposed to pay in case of its continuance, shall be applied as a single payment to the purchase of paid-up insurance.

3. Certain companies voluntarily apply all credited dividends to the continuance of the insurance; others voluntarily apply the legal reserve to the purchase of term insurance at the regular rates.

4. In some companies, all limited payment life policies and all endowment policies, after premiums for three (or two) years have been paid and the original policy is surrendered within a certain time, provide for paid-up assurance for as many parts (tenths, fifteenths, twentieths, etc., as the case may be), of the original amount assured, as there shall have been complete annual premiums received in cash by the Company.

535. The **Surrender Value** of a policy is the amount of cash which the company will pay the holder on the surrender of the policy. It is the legal reserve less a certain per cent. for expenses.

The Tontine Investment, Reserve Endowment, and other special policies guarantee to the policy-holder a definite surrender value at the termination of certain periods.

536. The **Expectation of Life** is the number of years which one may probably live. This average number of years has been determined from the experience of Insurance Companies.

TABLE OF RATES.

537. Annual premium for an Insurance of $1,000, with profits.

	LIFE POLICIES. Payable at Death, only.					ENDOWMENT POLICIES. Payable as Indicated, or at Death, if Prior.			
AGE.	ANNUAL PAYMENTS. For Life.	ANNUAL PAYMENTS. 10 Years.	ANNUAL PAYMENTS. 15 Years.	ANNUAL PAYMENTS. 20 Years.	AGE.	In 10 Years.	In 15 Years.	In 20 Years.	AGE.
25	$19 89	$42 56	$32 34	$27 39	25	$103 91	$66 02	$47 68	25
26	20 40	43 37	32 97	27 93	26	104 03	66 15	47 82	26
27	20 93	44 22	33 62	28 50	27	104 16	66 29	47 98	27
28	21 48	45 10	34 31	29 09	28	104 29	66 44	48 15	28
29	22 07	46 02	35 02	29 71	29	104 43	66 60	48 33	29
30	22 70	46 97	35 76	30 36	30	104 58	66 77	48 53	30
31	23 35	47 98	36 54	31 03	31	104 75	66 96	48 74	31
32	24 05	49 02	37 35	31 74	32	104 92	67 16	48 97	32
33	24 78	50 10	38 20	32 48	33	105 11	67 36	49 22	33
34	25 56	51 22	39 09	33 26	34	105 31	67 60	49 49	34
35	26 38	52 40	40 01	34 09	35	105 53	67 85	49 79	35
36	27 25	53 63	40 98	34 93	36	105 75	68 12	50 11	36
37	28 17	54 91	42 00	35 83	37	106 00	68 41	50 47	37
38	29 15	56 24	43 06	36 78	38	106 28	68 73	50 86	38
39	30 19	57 63	44 17	37 78	39	106 58	69 09	51 30	39
40	31 30	59 09	45 33	38 83	40	106 90	69 49	51 78	40
41	32 47	60 60	46 56	39 93	41	107 26	69 92	52 31	41
42	33 72	62 19	47 84	41 10	42	107 65	70 40	52 89	42
43	35 05	63 84	49 19	42 34	43	108 08	70 92	53 54	43
44	36 46	65 57	50 61	43 64	44	108 55	71 50	54 25	44
45	37 97	67 37	52 11	45 03	45	109 07	72 14	55 04	45
46	39 58	69 26	53 68	46 50	46	109 65	72 86	55 91	46
47	41 30	71 25	55 35	48 07	47	110 30	73 66	56 89	47
48	43 13	73 32	57 10	49 73	48	111 01	74 54	57 96	48
49	45 09	75 49	58 95	51 50	49	111 81	75 51	59 15	49
50	47 18	77 77	60 91	53 38	50	112 68	76 59	60 45	50

1. The above table represents the maximum rates of the leading New York companies. Surplus premiums or dividends are returned annually commencing at the payment of the second premium.

2. Policies which do not share in the dividends of the company, are issued at fixed rates 15 to 20% less than the above.

3. The above rates are for annual payments only. To obtain semi-annual payments, add 4% and divide by 2. To obtain quarterly payments, add 6% and divide by 4.

538. Annual Report of a Life Insurance Co., Jan. 1, 1882.

Amount of assets, Jan. 1, 1881		$36,889,011.66

REVENUE ACCOUNT.

Premiums	$6,003,036.16	
Interest and rents	2,033,650.00	8,036,686.16
		44,925,697.82

DISBURSEMENT ACCOUNT.

Losses by death, including Reversionary additions to same	1,569,854.22	
Endowments matured and discounted	1,015,256.22	
Annuities, dividends, and returned premiums on cancelled policies	2,236,379.97	
Taxes and re-insurances	173,608.64	
Commissions, brokerages, agency expenses and physicians' fees	626,253.30	
Office and law expenses, salaries, advertising, printing, etc.	307,392.81	5,928,745.16
		38,996,952.66

ASSETS.

Cash in bank and on hand	1,961,701.48	
Invested in United States, New York City, and other stocks	14,556,192.94	
Real estate	4,974,573.68	
Bonds and mortgages, first lien on real estate	15,313,278.95	
Temporary loans (secured by stocks, market value $1,300,000)	850,000.00	
Loans on existing policies	621,403.02	
Quarterly and semi-annual premiums on existing policies, due subsequent to Jan. 1, 1882	367,989.02	
Premiums on existing policies in course of transmission and collection	211,625.23	
Agents' balances	22,199.23	
Accrued interest on investments Jan. 1, 1882	317,989.11	38,996,952.66

LIABILITIES.

Adjusted losses, due subsequent to Jan. 1, 1882.	225,662.64	
Reported losses, awaiting proof, etc.	213,271.31	
Matured endowments, due and unpaid	32,780.98	
Premiums paid in advance	16,543.25	
Reserve for re-insurance on existing policies at 4½ per cent	30,682,025.00	31,170,283.18
Surplus at 4½ per cent		7,826,669.48
		38,996,952.66

EXAMPLES.

539. *1.* Find the amount of premium for an ordinary life policy (**526, 537**) of $5000, issued to a person 35 years of age.

2. What is the first annual premium of a life policy of $6000, issued to a person 30 years old, $1.00 being charged for the policy?

NOTE.—The policy fee is added to the first premium only.

3. Find the annual premium for a 20-payment life policy (**527, 537**) of $4000, issued to a person 28 years old.

4. What annual premium must be paid for a 20-year endowment policy (**529**) of $8000, age of the insured at nearest birthday, 40 years? If the insured dies during the tenth year, how much more would have been paid than if he had been insured on the ordinary life plan?

5. What is the average daily cost of a life policy for $1000, no allowance being made for probable dividends, insurance commencing at age 25? At 35? At 45?

6. How much must a person, aged 35, lay aside weekly to secure a life policy of $1000, payable in 20 annual payments?

7. When 40 years old, a person took out a 20-year endowment policy of $10000. He survived the endowment period. How much less did he receive than he paid as premiums, not reckoning interest?

8. Mr. A. when 26 years old took out an ordinary life policy of $20000. He died aged 41 years 2 months. How much more did his heirs receive than had been paid as premiums, no allowance being made for interest?

9. In the above example, supposing money to be worth 6% (simple interest), what was the net gain of the above insurance?

10. The annual premium, without profits, on a life policy of $10000 at age 35 is $222. How much would it be necessary to invest at 6% interest to secure the payment of the annual premium? How much would the insured leave his family at his death?

11. A gentleman, age 30, insures his life for $20000, ordinary life plan. How much must he place in trust so that the interest at 5% will be sufficient to pay the premiums on the policy? At his death, how much does he leave his family?

12. Mr. C. when 25 years of age secured a 20-year endowment policy of $6000; when he was 30 years of age, he obtained an ordinary life policy of $4000; when 35 years of age, he took out a 20-payment life policy of $10000. What was the total annual premium after taking the last policy?

13. Suppose Mr. C. had died at the age of 40½ years, how much more would his heirs receive than had been paid as premiums?

14. A single premium for an assurance of $1000, without profits, for a person 32 years of age, is $300. What would be the excess of the assurance over the amount produced by placing the money at compound interest (**341**) at 4%, supposing the insured to live 20 years? 30 years? What would be the excess of the amount produced by the money at interest at 5% over the assurance in 30 years?

15. Mr. B., age 40, has $10000 at interest at 6%, which he intends to leave his family. What will this amount to at compound interest (**341**) in 25 years at 6%? How much will he leave his family if he takes out a life policy and pays the premium with the interest on his investment of $10000?

16. Mr. A., aged 30, secures an ordinary life policy, annual premium $100. How much more would his heirs receive from the insurance company than from the money at compound interest (**342**) at 5%, should he die at the age of 32? Of 40? Of 50? At about what age would the amount received from the money at interest exceed the assurance?

17. What is the semi-annual premium (**537**, 3) on a 20-year endowment policy for $6000, age 32? The quarterly premium?

18. Mr. A., who will be 35 years of age July 1, takes out Apr. 1 a 20-payment life policy for $10000, premium payable semi-annually. Mr. B., of the same age, takes out Apr. 1 the same kind of policy for $5000, and Oct. 1, another policy of the same kind for $5000, premium payable annually. How much less does Mr. B. pay as premium each year than Mr. A.? (**537**, 3.)

19. An ordinary life policy issued at age 35 for $10000 has, at age 45, a 4% reserve of $1262.60. How much non-participating paid-up insurance will this amount purchase, the single premium rate per $1000 at age 45 being $475.44?

20. In the statement, Art. **538**, the surplus is what per cent. of the reserve required by the State of New York? The net assets (the total assets less the first four items of the liabilities) are what per cent. of the reserve?

GENERAL AVERAGE

Definitions.

540. If, in time of danger [illegible] voluntarily incurred for [illegible] cargo, such loss or expense [illegible] age." [illegible] upon the value of all [illegible].

All other losses and [illegible] "Particular Average" nature, and are to be borne by the [illegible] apply.

541. The losses and expenses [illegible] as follows:

1. Jettison, or throwing overboard [illegible] ship: damage to cargo or water [illegible] jettison: damage by chafing or [illegible] cargo jettisoned.

2. Sacrificing ship's materials, as [illegible] spars, etc. One-third of the cost of repairs of ship's materials is a special charge on the ship, as the new work is considered better than the old. No deduction is made for anchors.

3. Expense of floating a stranded ship.

4. Expense of entering a port of refuge, either to repair damage which renders it dangerous to remain at sea, whether such damage were caused by accident or sacrifice; or otherwise to avert a common danger.

5. Expense of discharging cargo for the purpose of making repairs, warehouse rent, reloading cargo, outward expenses, etc.

6. Wages and provisions of crew from the date of bearing up until ready for sea.

542. Contributory Interests and Values.—The ship contributes on its full value at the time which is made the basis of contribution.

The cargo contributes on its net market value at the port of destination, less freight and charges saved.

The freight contributes on the full amount, less ½ for the wages, etc., of crew. In the States of New York, Virginia, California, and some others, ⅓ is deducted.

The underwriters (Insurance companies) contribute to the general average such a part of the expense as the insured value is of the market value of the goods (**405**). If, for example, a cargo is insured for $10000 and is worth in the market $12000, the underwriters are liable to pay ⅚ of the general average expense.

543. To give rise to general average, it must be shown that there was an imminent common danger, that the sacrifice was voluntary and necessary, and that the act was prudent and successful.

544. An **Average Adjuster** is a person who is familiar with the general average laws of the leading commercial nations, and who adjusts and apportions the losses and expenses of a general average.

The principal difficulty of an adjuster is to decide whether the loss should be made good by a general average or should be made a special charge (particular average) upon some particular interest. After the general average charges are determined, the apportionment of the loss among the several contributory interests is a simple arithmetical problem.

EXAMPLES.

545. *1.* The bark *Liberty* sailed from New York for Galveston with the following cargo: Shipped by A, $5600; by B, $8700; by C, $16308; by D, $8360. After two days out the bark encountered heavy gales and was damaged to the amount of $630.14. On the fifth day the vessel began to take water, and for the safety of the vessel and the cargo the bark bore away for New York for repairs. The disbursements of the agent at New York were as follows: Custom-house fees, pilotage, protest, towage, unloading and reloading cargo, wharfage, inspection, consul fees, $1369.43; bill of H. Robin & Co., shipwrights, etc., $436; bill of Joseph Patti, ceiling ship $194.14. Agent's commission for advancing funds [illegible] incurred [illegible]

[illegible] is entered [illegible]

[illegible] is also entered [illegible]

[illegible] average column [illegible]

[illegible] upon the [illegible]

SETTLEMENT.

	Dr.		Cr.		Balances.			
					To pay.		To receive.	
Vessel and Owners.								
Pay ship's proportion of Gen. Aver.	***							
" freight's " "	***	**						
" owner's column.	***	**						
Receive seamen's wages.			***	**	663	34		
Cargo.								
Pay proportion of Gen. Average.	****	**			1753	56		
Agents of Vessel.								
Receive their disbursements.			****	**				
" " commission.			***	**			2316	90
Adjusters.								
Receive their fee.			***				100	
	3047	37	3047	37	2416	90	2416	90

2. The general average charges were $4375.86, and the contributory interests $64325. What was the per cent. of loss? What was the loss of Mr. B., whose goods were valued at $7250?

3. Suppose A's goods in Ex. 1 were insured for $5000, how much of the loss would be shared by the insurance company?

4. The ship *Amazon*, from Aspinwall to New York, being in distress, threw overboard part of the cargo, cut away the masts, and finally bore away to a port of refuge to repair in order to complete the voyage. The cost of replacing masts and rigging cut away was $6000 (less $\frac{1}{3}$ new for old); the cargo jettisoned was worth compared with sound cargo delivered at destination $2000; freight on cargo jettisoned, $200; expenses of entering port of refuge, discharging, storing and reloading cargo, $1000; wages of master and crew from time of bearing away until ready for sea, $600; provisions of master and crew for same time, $500; adjuster's fee, $100. The vessel was valued at destination at $20000 (deduct gross repairs and add amount made good); cargo, value on arrival, $40000 (add amount made good); freight collected, $4000 (add amount made good and deduct $\frac{1}{3}$). What was the per cent. of loss, and how was the settlement made?

5. The cargo of the ship *Amazon* was insured for $36000. How much was the claim against the insurance company?

[illegible] passage from Liverpool to Boston. [illegible] the amount of $1,580. [illegible] the port of [illegible] the masts and rigging [illegible] was $477 less [illegible] damage. [illegible] cargo [illegible] discharging [illegible] at Boston was [illegible] amount [illegible] Boston. [illegible] following [illegible] The cargo [illegible] settlement [illegible]

[illegible]

CLEARING HOUSES.

DEFINITIONS.

546. A Clearing House is a place where the daily exchanges are effected between banks, and where the payments of the balances resulting from such exchanges are made.

The New York Clearing House was the first of the kind established in America, and began its operations Oct. 11, 1853. Since that time Clearing Houses have been established in all the principal cities of the country, there now being twenty-two in the United States.

Before the Clearing House at New York was established it was necessary for each bank every morning to make up its accounts with every other bank, and to send a messenger to the debtor banks to present accounts and receive balances, which were adjusted in gold. This finally became so laborious, dangerous, and complicated, that balances were arranged weekly every Friday. The Clearing House obviated this. Its settlements are made so rapidly that the transactions adjusted through it have amounted in a single day to over $250,000,000—all settled within an hour.

The establishment of the Clearing House closed 2500 bank ledger accounts, with numerous daily entries in each, and enabled the banks to settle with each other every day without loss or delay, and with comparatively little trouble.

547. The **New York Clearing House Association** is composed of 45 national and 12 State banks, and the assistant treasurer of the United States at New York. The remaining banks (4 national and 9 State) make their exchanges through the others.

During the year ended October 1, 1881, the total exchanges were more than $48,000,000,000, while the balances paid in money were less than $1,800,000,000. The average daily balances paid were nearly $6,000,000, or about 3⅛% of the amount of the settlements. The balances paid in money during the year consisted of $1,394,966,000 in clearing house certificates of the Bank of America (**548**, 15), legal-tenders (**189**) amounting to $8,633,161, and $372,419,000 in gold coin, weighing 686⅛ tons. The largest transactions for any one day were on the 28th of November, 1880, and amounted to $295,821,422.37.

Daily Routine of the New York Clearing House

[illegible]

5. Promptly at 10 o'clock, the assistant manager strikes a bell and says "Take your places"—"Order"—"Ready, go." A fine is imposed upon those who are not in their places at the first ringing of the bell.

6. Each Settling Clerk is now at his desk and has before him the "Settling Clerk's Statement" (See Form 4), the debit side of which shows the amount of checks, etc., his bank has against each of the other banks. The credit side, on which is entered the amounts received from the other banks, is now blank.

7. The messengers stand opposite their respective desks, and have the packets arranged in an open box in the order of their delivery. Thus, the messenger of No. 6 has his packets in the following order: 5, 4, 3, 2, 1, 76, 75, 74, 72, etc. He also has a "Receipt List," which is a copy of the "Banks Dr." of the "Settling Clerk's Statement" with a blank column for the signatures of the clerks of the receiving banks.

8. At the second ringing of the bell, each messenger advances one step forward and is brought opposite the first desk at which his delivery is to be made. He delivers the packet of checks designed for it, and also the "Receipt List." The Settling Clerk compares the amount on the packet with the amount on the list, and, if correct, signs his initials opposite the amount, and returns the list to the messenger. He also enters the amount received on his statement opposite the name of the bank under the head of "Banks Cr.," before receiving another packet. The messenger goes through the delivery at each desk in like manner. The whole line of messengers advance at the same time, and each messenger performs a similar operation.

In 10 or 15 minutes the circuit of the 58 desks is made, bringing each messenger to the starting point opposite his own desk. His "Receipt List," signed by every Settling Clerk, is the voucher to his bank that he has delivered all the checks intrusted to his care.

9. Each Settling Clerk has now on his desk the packets of checks which constitute his *Debit Exchange*. He has already entered the amounts in his Statement under the head of "Banks Cr."

As soon as the exchange is made each messenger returns to his bank with the packets of checks, and with a memorandum of the total *debit exchange* which has been furnished to him by the Settling Clerk, and the balance in favor of or against the bank. The Settling Clerks are obliged to remain until the assistant manager announces an exact proof.

The messengers call back the amounts on the packets as they place them in their satchels preparatory to returning to their respective banks.

10. The Settling Clerks carefully revise the addition of the column "Banks Cr.," and send to the desk of the assistant manager a "Balance Ticket," which shows the amount brought, the amount received, and the balance for or against the bank. (See Form 2.)

The amounts received are entered on the Clearing House Proof under the head of "Banks Dr.," and the balances in the proper columns. The sum of the amounts under the head of "Banks Dr." should equal the sum under "Banks Cr." (See **548**, 4.)

[illegible]

[illegible]

[illegible] Clearing House.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] each messenger distributed a set of [illegible] corresponding with the amounts on [illegible] compared with the amounts on the [illegible] and ought to [illegible] checks have been taken away.

No. 8.

[illegible] BANK.

[illegible] No. 6

[illegible]

[illegible]

[illegible] 10:45 or [illegible] their work. [illegible] the assistant [illegible] thereon. The correct [illegible] the right [illegible] clerk of [illegible] the amount [illegible] follows the [illegible] line the [illegible] No. [illegible] additions are correct.

[illegible]

[illegible]

15. To save the risk and inconvenience of handling gold, settlements are made by gold Clearing House Certificates of the Bank of America, the common coin depository of the Associated Banks. These certificates are valid only in the Clearing House settlements, or directly between the banks. Balances less than $1000 are paid in gold or legal-tenders (**188**).

16. Errors in exchanges, and claims arising from the return of checks, or from any other cause, are adjusted directly between the banks who are parties to them, and not through the Clearing House.

(Form 4.)*

No. 6. BANK OF AMERICA.

SETTLING CLERK'S STATEMENT, April 5, 1882.

No.	Banks.	Banks Dr.			Banks Cr.			No.
1	B'k of N. Y. Nat'l Bk'g Ass'n,	362	189	76	426	134	42	1
2	Manhattan Company,	228	065	43	280	772	87	2
3	Merchants' National Bank,	756	784	80	652	668	16	3
4	Mechanics' National Bank,	275	238	92	438	591	34	4
5	Union National Bank,	537	564	27	377	418	72	5
7	Phenix National Bank,	142	728	11	344	836	19	7
8	National City Bank,	876	439	42	615	971	24	8
10	Tradesmen's National Bank,	169	235	08	313	185	50	10
11	Fulton National Bank,	68	482	58	131	731	34	11
	Exchanges,	3416	728	37	3581	309	78	
	Balance,	164	581	41				

(Form 5.)

NEW YORK CLEARING HOUSE PROOF, April 5, 1882.

No.	Banks.	Due Clearing House.			Banks. Dr.				Banks. Cr.				Due Banks.			No.
1	B'k of N. Y. Nat'l Bk'g Ass'n,	153	161	54	2	417	853	21	2	734	415	38	316	562	17	1
2	Manhattan Company,				3	670	729	36	3	517	567	82				2
3	Merchants' National Bank,				4	189	437	29	4	484	123	49	294	686	20	3
4	Mechanics' National Bank,				2	234	163	46	2	425	876	50	191	713	04	4
5	Union National Bank,	301	190	94	2	874	109	28	2	572	918	34				5
6	Bank of America,	164	581	41	3	581	309	78	3	416	728	37				6
7	Phenix National Bank,	245	885	43	2	537	418	42	2	291	532	99				7
8	National City Bank,	176	895	20	1	764	333	50	1	587	438	30				8
10	Tradesmen's National Bank,				1	437	528	49	1	573	419	22	135	890	73	10
11	Fulton National Bank,					709	446	17		812	308	55	102	862	38	11
		1041	714	52	25	416	328	96	25	416	328	96	1041	714	52	

---

* For economy of space, Forms 4 and 5 are given with only 10 banks.

DETECTION OF ERRORS

IN

TRIAL BALANCES.

440. The following hints apply to the detection of errors in trial balances, or in any operation in which errors are made in addition or subtraction, or in transferring numbers from one place to another.

[illegible] Ascertain the exact amount of the error. Much time is sometimes wasted in looking for errors which do not actually exist.

[illegible] Prove carefully the additions of the trial balance before looking for the error in the ledger or other books.

[illegible] If the error is [illegible] number, as 1000, 100, 50, etc., it is probably an error in addition or subtraction.

[illegible] If an amount is entered on the wrong side of an account, or [illegible] amount [illegible] incorrectly [illegible] two sides, the error will be [illegible] the amount.

[illegible] If the digits of any number are written to the right or left [illegible] one or more places, and the error be divided by 9, 99, or [illegible] respectively, the quotient will be the number.

Thus, if [illegible] be written $427, the error will be $422.73; which divided by [illegible], the quotient will be $4.27.

[illegible] The number of 9's by which the number can be exactly divided is equal to the number of places which the number has been transferred to the right or left.

[illegible] If two consecutive digits of any number are transposed, the [illegible] the quotient [illegible] will express the difference between the [illegible]

[illegible] 114 the error will be 36; which [illegible] 3 and 7. The same error 36 [illegible] 1 and 5, 2 and 6, 4 and [illegible]

[illegible] a number of figures [illegible] been omitted.

[illegible] amount.

MISCELLANEOUS EXAMPLES.*

550. *1.* Add $17\frac{1}{3}$, $28\frac{3}{4}$, $36\frac{1}{2}$, $44\frac{5}{8}$, $89\frac{7}{12}$, and $76\frac{5}{6}$; multiply the sum by 87; subtract $1022\frac{17}{24}$ from the product; and divide the remainder by $234\frac{2}{3}$.

2. Divide eighty-three, and seventy-five hundredths by one hundred and twenty-five ten-thousandths; add to the quotient sixty-eight, and six hundred and twenty-five thousandths; and multiply the sum by three, and two-tenths.

3. How many minutes in the month of February, 1900?

4. Find the cost of 7312 pounds of meal at $2.25 per *cwt.*

5. The difference in the local time of two places is 1 *hr.* 7 *min.* 13 *sec.*; what is the difference in longitude?

6. Find the number of square yards of paving in a street, 3000 *ft.* long and 50 *ft.* wide.

7. What is the charge for packing, marking, and shipping 251 bales merchandise at 5*s.* 6*d.* per bale?

8. If 46 *T.* 12 *cwt.* of coal are worth $174.75, what is the value of 37 *T.* 8 *cwt.*?

9. How many square yards of linoleum would cover a floor 22 *ft.* 6 *in.* by 15 *ft.* 4 *in.*? Find its value at 63¢ per *sq. yd.*

10. What is the freight of 5 *T.* 9 *cwt.* 2 *qr.* 8 *lb.*, at 70 shillings per ton (2240 *lbs.*)?

11. Find the cost of 4 *T.* 7 *cwt.* 3 *qr.* 20 *lb.* of iron, at £15 4*s.* 6*d.* per ton (2240 *lbs.*).

12. What is the weight in grams of the U. S. gold dollar?

13. What is the value of a *Lac* (100,000) of rupees in U. S. money? (See Art. **192**, India.)

14. A bank collected a draft of $9375.16. What were the proceeds, the charge for collection being $\frac{1}{8}$%?

15. What is the cost of insuring $18000 at 75¢ per $100?

16. What is the cost of 250 *ft.* 3-ply hose, at 60 *cts.* per foot, less 30 and 10%, and 5 sets couplings at $1.50 each?

17. What is $2\frac{1}{2}$% of £159 13*s.* 10*d.*

18. A's property is assessed at $7500, and the rate of taxation is $2.165 on $100. What is his tax, including a commission of 1%?

---

* Answers omitted.

[illegible] amounting to [illegible]

[illegible] amounting [illegible] 30 [illegible] The above [illegible]

[illegible] per ton. [illegible] He sold the [illegible] What were [illegible]

[illegible] and [illegible] from [illegible] What is the [illegible]

[illegible] amounting to [illegible] paid in [illegible] the under- [illegible] of 5%. [illegible] books of the [illegible] expiration of the [illegible]

[illegible] goods amounting to $5000 on [illegible] discount in 30 days, or 2% [illegible] makes a payment of $2000, and [illegible] due July 9, the end of [illegible]

[illegible] merchandise amounting to [illegible] months, or 5% discount in [illegible] made a payment [illegible] Nov. 15?

[illegible] amounting to [illegible] 30 days. He [illegible] expiration of the [illegible] should have the [illegible] time elapsed, [illegible] compound [illegible]

[illegible] of goods [illegible] of the goods [illegible] the invoice [illegible]

28. Find the total freight on 68 *ft.* mdse. at 35 shillings per ton (40 *cu. ft.*), and 123 *ft.* at 40 shillings per ton, plus 10% primage on each item.

29. A merchant buys a bill of goods amounting to $1000 on a credit of four months, or 6% off for cash. He pays $500 cash. For what amount should his account be credited?

30. Bought coal by the long ton at $3.64, and sold by the short ton at $4.25. What was the gain per cent?

31. A bought a bill of merchandise July 24, 1879, amounting to $6287.45 on the following terms: 6 months, or less 4% 30 days. He paid on account Aug. 23, 1879, $5000, with the understanding that the payment would cancel an equitable amount of the bill. How much was due Jan. 24, 1880?

32. A commission merchant in Chicago sells for me 12 bales brown sheeting, each bale containing 800 yards, at 7 cts. per yard; pays transportation and other charges amounting to $72; and invests the proceeds in flour at $4.80 per barrel. If he charges $2\frac{1}{2}$% for selling and $1\frac{1}{2}$% for purchasing, how many barrels of flour does he send me?

33. Find the date of maturity and the net proceeds of a note for $5000, dated May 16, payable 4 months after date, and discounted July 21 at 6%.

34. When the above note became due, its maker had discounted at 6% a new note, payable 90 days after date, whose proceeds were sufficient to pay the first note. What was the face of the new note?

35. Apr. 1, a merchant buys a quantity of coffee on 90 days' credit, with privilege of discounting within 30 days from date of purchase at the rate of 6% per annum for the unexpired time. Apr. 16 he makes a payment of $28000 on account, no actual invoice having been rendered. May 1 he receives the invoice, amounting to $29215, and on the same date full settlement is made. What amount was required to cancel the bill? (Exact days, 360 days to the year.)

36. Divide $2000 in such a manner between two brothers, aged 16 and 19 years respectively, so that when they arrive at 21 years of age they will have equal amounts, money being worth 6% simple interest.

37. What would be the share of each if money is worth 6% compound interest?

38. Find the amount due on the following note Jan. 1, 1883, by the United States and the Mercantile Rules:

5000\frac{00}{100}$. DAVENPORT, IOWA, May 1, 1878.

On demand, I promise to pay EDWIN D. MORGAN, or order, Five thousand dollars, with interest at ten per cent., for value received. E. H. CONGER.

On this note the following payments were indorsed:

Received Jan. 16, 1879, $400. Received Dec. 12, 1880, $150.
Received Sept. 7, 1879, $100. Received Aug. 18, 1881, $850.
Received May 1, 1880, $500. Received Apr. 23, 1882, $100.

39. How much would have been due on the above note if no rate of interest had been mentioned in the note?

40. What is the value of a draft on Hamburg of 17468 marks at 95⅜?

41. C. of London owes me for goods sold on my account, £129 18s. 7d. How much do I receive in payment, if I draw a bill of exchange for the amount and sell it at 4.85⅝?

42. My agent in Paris buys an invoice of merchandise amounting to 12488 francs, at a commission of 2½%. What is the cost of the draft which I remit in payment, the rate of exchange being 5.17⅜?

43. An exporter sold the following bills of exchange through a broker: 10000 francs on Paris at 5.16⅜, £375 16*s.* 8*d.* on London at 4.83⅝, 16480 marks on Hamburg at 94⅞, 5287 guilders on Amsterdam at 41⅛. What were the proceeds, brokerage ⅛%?

44. A commission merchant at New York sells goods for A. of Havre to the amount of $3435.27, and charges a commission of 2½% for selling. What is the face of the draft which he purchases and remits in settlement, exchange being 5.27?

45. My agent in London has purchased for me, at a commission of 2½%, 375 dozen kid gloves at 49*d.* per dozen, and 636 yards silk at 9*s.* 6*d.* per yard. When exchange is $4.86¾, what will be the cost of the draft which I remit to him in settlement?

46. Purchased in England, merchandise amounting to £324 10*s.* 7*d.*, and paid freight and duties $487.34. How much per £ must I sell these goods to gain 12½% on the full cost, and what must I charge for an article invoiced at 6*s.* 8*d.*, exchange 4.88?

47. Bought stock at 1.16⅜ and sold at 1.12⅞. Loss, $12
What was the par value of the stock?

48. Average the following account:

Mar. 16,	1882,	$874.32	on	30 days	credit.
" 31,	"	518.65	"	60 "	"
May 5,	"	373.78	"	4 months	"
" 21,	"	429.31	"	60 days	"
June 18,	"	657.70	"	30 "	"
July 3,	"	242.28	"	60 "	"
" 24,	"	983.75	"	4 months	"
Aug. 19,	"	716.30	"	4 "	"
Sept. 13,	"	536.60	"	60 days	"

49. Average the following account. What will be the amount due Jan. 1, 1883?

Dr. Daniel S. Lamont, *Albany, N. Y.* *Cr.*

1882.				1882.			
July 16	Mdse., 4 *mo.*	$876	14	Sept.10	Cash, . . .	$900	00
Aug. 4	" 60 *da.*	415	65	" 21	" . . .	700	00
Sept.10	" 30 *da.*	797	38	Oct. 13	" . . .	500	00
" 21	" 30 *da.*	686	96	" 31	Mdse., 30 *da.*	322	16
Oct. 13	" 4 *mo.*	524	27	Nov. 2	Cash, . . .	400	00
" 31	" 30 *da.*	859	75	" 28	Note, 4 *mo.*	800	00
Nov.28	" 60 *da.*	263	31	Dec. 27	Cash, . . .	500	00
Dec. 1	" 60 *da.*	172	64				
" 30	" 30 *da.*	938	52				

50. Prepare an account current, including interest at 6% to Jan. 1, 1883, from the above ledger account, according to the form and method of Art. **454**.

51. Sold five $1000 bonds at 1.16⅜, and invested the proceeds in railroad stock at 92⅞, which I sold at 98¼. What was the gain on the stock, allowing usual brokerage?

52. Sold Aug. 11, 1879, 500 shares Chicago & Alton, s. 10, at 94½, and covered my short sale Aug. 16, 1879, at 91. What was my profit, allowing the usual brokerage?

53. What annual income will be obtained by investing $9923.75 in bonds, bearing 5% interest, and purchased at 1.16¾?

54. What is the duty on a block of marble 2 × 3 × 7 ft., imported from Italy, dutiable value 3450 lire, and duty $1 per cubic foot and 25%?

APPENDIX

[illegible] EXERCISES, SHORT METHODS, ETC.

[illegible] numbers [illegible]

[illegible] Thus [illegible]

[illegible] numbers [illegible] repeated [illegible]

[illegible]

[illegible] with [illegible]

[illegible] adding each [illegible] adding the [illegible] upwards and downwards, the [illegible]

[illegible] number less [illegible] numbers [illegible] will be the [illegible] will [illegible]

[illegible] number [illegible]

from the last number, omitting the fourth figure and borrowing from the fourth place when necessary; so continue until sixteen subtractions have been made. The seventh and sixteenth remainders will be the same. Add the numbers. The three right-hand figures of the sum will be the same as the three right-hand figures of the product obtained by multiplying the original number by 391. (See Ex. 4, Art. **555**.)

554. Drill Exercise in Multiplication and Division.—Take any number; find the continued product of it and any set of numbers. Use the last product as a dividend, and divide it by the same numbers in the same order, using each quotient as a dividend for the next division. The last quotient will be the original number. (See Ex. 5, Art. **555**.)

NOTE.—In the drill exercises in addition, multiplication, and division, if the original number is a multiple of 9, each number and result will be a multiple of 9, and therefore the sum of the digits of each number will be a multiple of 9. This property of 9 may be used in the detection of errors.

555. EXAMPLES.

(*1.*)	(*2.*)	(*3.*)	(*4.*)	(*5.*)
Add	Add	Add	1000	87 × 2
3456	$37.16	347	517	174 × 3
9716	875.25	347	483	522 × 4
2356	412.75	694	034	2088 × 5
7327	734.	1388*	449	10440 × 6
2468	147.03	2429	585	62640 × 7
7535	948.26	4511	864	438480 × 8
2845	272.72	8328	721*	3507840 × 9
9610	371.59	15268	143	2) 31570560
2581	87.20	28107	578	3) 15785280
1473	3.16	51703	565	4) 5261760
7812	27.84	95078	013	5) 1315440
1593	375.13	174888*	552	6) 263088
4826	617.37	383088	461	7) 43848
7374	583.14	24557	091	8) 6264
8259	27.48		370	9) 783
4374	344.22		721*	87
3213	5.76		8147	

556. Short method of finding the balance of an account.

Ex. Find the balance of the following ledger account:

Dr. C. E. & W. F. PECK. *Cr.*

[illegible]					[illegible]				
Mar. 16	Merchandise.	1192	97		Apr. 22	Cash.	800		
" 30	Sundries.	567	40		" 22	Bills receivable.	1009		
" 31	Merchandise.	884	80		May 1	Merchandise.	317	22	
Apr. 22	Interest.	16	48		" 17	Cash.	424	79	
" 24	Merchandise.	846	51		July 1	Balance.	852	84	
May 17	"	887	35						
		8394	91				8394	91	
July 1	Balance.	852	84						

ANALYSIS.—It can readily be seen that the debit side is greater: therefore add that side first and write the sum as the total or footing of each side. Then pass to the other side of the account. The sum of the first column is 17, which subtracted from the next higher number, 21, ending with 1, the corresponding figure of the total, leaves 4, which write as the first figure of the balance, carrying the 2 to the next column. (If the right-hand figure of the sum of any column is the same as the corresponding figure of the total, subtract it from itself, and not from the next higher number ending with the same figure; or write 0 in the balance and carry the left-hand figure of the sum.) The sum of the figures in second column plus 2 carried is 11, which subtracted from 19 leaves 8, the second figure of the balance. Proceed in like manner until all the figures of the balance are obtained. Prove by adding all the numbers, including the balance.

EXAMPLES.

557. Find the balances of the following accounts:

(1.) Dr.	(1.) Cr.	(2.) Dr.	(2.) Cr.	(3.) Dr.	(3.) Cr.
817.20	812.20	237.25	112.27	1075.	375.60
222.22	214.13	900.	218.36	2316.42	218.24
427.30	375.	800.	717.49	812.10	717.37
810.75	412.	718.24	648.	936.40	244.45
416.30	717.	218.75	118.75	4312.	946.55
225.			538.96		222.45
719.46			905.15		105.75

SHORT METHODS IN MULTIPLICATION.

558. To multiply any number of two figures by 11.

559. RULE.—*Place the sum of its digits between them when the sum is less than 10. When the sum is 10 or more than 10, write its right-hand figure in the second place and carry one to the left-hand figure of the multiplicand.*

EXAMPLES.

560. *1.* Multiply 34 by 11.

ANALYSIS.—3 + 4 = 7, which placed between 3 and 4 produces the product 374.

2. Multiply 68 by 11.

ANALYSIS.—6 + 8 = 14. Write 4 in the second place and carry 1 to the 6, the left-hand figure of the multiplicand producing the product 748.

3. Multiply the following numbers by 11 : 24, 16, 18; 32, 43, 33, 72, 81, 37, 44, 92, 87, 93, 64, 35, 36, 47, 17, and 19.

561. To multiply any number by 11.

562. RULE.—*Write the 1st right-hand figure, add the 1st and 2nd, the 2nd and 3rd, and so on; finally write the left-hand figure, carrying as usual.*

EXAMPLES.

563. *1.* Multiply 783742 by 11. *Ans.* 8621162.

ANALYSIS.—Write the right-hand figure 2; for the remaining figures of the product, add 2 to 4, 4 to 7, 7 to 3, 3 to 8, 8 to 7, and write the left-hand figure, carrying when necessary.

2. Multiply the following numbers by 11 :—245, 346, 325, 416, 784, 517, 875, 918, 4218, 7324, 7218, 1728, 4375, and 8376.

564. To multiply by any number of two figures ending with 1.

565. RULE.—*Multiply by the tens of the multiplier, writing the product under the multiplicand one place to the left, and add. Or,* *Write as the first figure of the product the unit figure of the multiplicand; multiply each figure of the multiplicand by the tens of the multiplier, and at the same time, add mentally to each product the figure to the left of the one multiplied, carrying as usual.*

EXAMPLES.

566. 1. Multiply 456 by 61.

1ST OPERATION	2ND OPERATION
456 × 61	456
2736	61
27816	27816

ANALYSIS. 2ND METHOD.—Write 6 in the product. 6 × 6 + 5 = 41. Write 1 and carry 4. 6 × 5 + 4 (carried) + 4 = 38. Write 8 and carry 3. 6 × 4 + 3 (carried) = 27.

Multiply	Multiply
2. [illegible] by 91; by 41.	5. 2345 by 121; by 111.
3. [illegible] by 81; by 71.	6. 7416 by 51; by 81.
4. [illegible] by 21; by 81.	7. 8324 by 41; by 21.

NOTE.—When the multiplier is any digit, any number of ciphers, and 1, the above principle may also be applied.

Multiply	Multiply
8. [illegible] by 401; by 401.	11. 48 by 701; by 801.
9. 235 by 201; by 701.	12. 376 by 201; by 901.
10. [illegible] by 301; by 501.	13. 87 by 3001; by 4001.

567. To multiply by any number between 12 and 20.

568. R[illegible]. *Multiply by the units of the multiplier,* [illegible]

[illegible]

EXAMPLES.

569. *1.* Multiply 456 by 18.

1ST OPERATION.	2ND OPERATION.
456	456
3648	18
8208	8208

ANALYSIS, 2ND METHOD.—8 × 6 = 48. Write 8 and carry 4. 8 × 5 + 4 (carried) + 6 = 50. Write 0 and carry 5. 8 × 4 + 5 (carried) + 5 = 42. Write 2, and carry 4. 4 + 4 = 8.

Multiply
2. 785 by 13 ; by 17.
3. 378 by 14 ; by 16.
4. 522 by 15 ; by 19.
5. 376 by 18 ; by 16.

Multiply
6. 1234 by 14 ; by 16.
7. 2345 by 16 ; by 18.
8. 3456 by 19 ; by 13.
9. 7891 by 17 ; by 15.

NOTE.—The above principle may also be applied when the multiplier consists of 1, one or more ciphers, and a digit.

Multiply
10. 875 by 101 ; by 108.
11. 936 by 102 ; by 103.
12. 877 by 104 ; by 106.
13. 736 by 105 ; by 109.

Multiply
14. 147 by 1008 ; by 1001.
15. 385 by 1004 ; by 1007.
16. 783 by 1005 ; by 1003.
17. 546 by 1007 ; by 1006.

570. To multiply by any number ending with 9.

571. RULE.—*Multiply by 1 more than the given multiplier, and from the result subtract the multiplicand.*

EXAMPLES.

572. *1.* Multiply 387 by 49.

OPERATION.

387 product by 1
19350 " " 50 (See Art. **42**, Ex. 13.)
18963 49 (Subtracted downwards.)

Multiply
2. 76 by 49 ; by 39.
3. 87 by 29 ; by 99.
4. 45 by 59 ; by 69.

Multiply
5. 312 by 19 ; by 89.
6. 427 by 39 ; by 79.
7. 825 by 29 ; by 69.

573. To multiply by any multiple of 9 less than 90.

574. Rule.—*Multiply by the multiple of ten next higher than the given multiplier, and from the result subtract one-tenth of itself.*

EXAMPLES.

575. *1.* Multiply 785 by 63.

OPERATION.

$$\begin{array}{rlr}
785 & & \\
70 & & \\ \hline
54950 & \text{product by} & 70 \\
5495 & \text{“ \quad “} & 7 \\ \hline
49455 & & 63
\end{array}$$

Analysis.—63=70−7. 785 × 70 = 54950. Divide 54950 by 10 by placing its digits one place to the right. 54950−5495 = 48455.

Multiply
2. 67 by 18; by 27.
3. 34 by 36; by 45.
4. 77 by 54; by 63.
5. 84 by 72; by 81.

Multiply
6. 345 by 36; by 45.
7. 567 by 18; by 72.
8. 518 by 27; by 63.
9. 724 by 54; by 81.

576. To multiply by 25.

577. Rule.—*Add two ciphers and divide the result by 4. Or,*

Divide the number by 4; if there is no remainder add two ciphers; if there is a remainder of 1, add 25; of 2, add 50; of 3, add 75.

EXAMPLES.

578. *1.* Multiply 446 by 25.

OPERATION.

$$\begin{array}{r}
4\,\overline{)44600} \\
11150
\end{array}$$

Analysis.—Since 25 is equal to 100 divided by 4, multiplying by 100 and dividing the result by 4, is the same as multiplying by 25.

2. Multiply the following numbers by 25:—24, 36, 37, 49, 62, 387, 448, 512, 746, 424, 817, 937, 544, 717, 318, 324, 256, 556, 9224, 8378, 5280, 1728, 5648.

579. To multiply by 125.

580. RULE.—*Add three ciphers, and divide by eight.*

EXAMPLES.

581. *1.* Multiply 637 by 125.

OPERATION.

8) 637000
    79625

ANALYSIS.—Since 125 is one-eighth of 1000, multiplying by 1000 and dividing the result by 8, is the same as multiplying by 125.

2. Multiply the following numbers by 125 :—32, 48, 76, 87, 92, 88, 112, 147, 317, 324, 325, 378, 419, 516, 875, 819, 725, 717, 998, 444, 1234, 5287, 7326, 8317, 1728.

582. To multiply by any number one part of which is a factor of another part.

EXAMPLES.

583. *1.* Multiply 576 by 287.

OPERATION.

576
287
4032 product by 7.
16128 " " 28 = 4 times product by 7.
165312 " " 287.

2. Multiply 567 by 936.

OPERATION.

567
936
5103 product by 9.
20412 " " 36 = 4 times product by 9.
530712 " " 936.

Multiply

3. 227 by 369; by 427.
4. 516 by 246; by 568.
5. 344 by 126; by 124.
6. 728 by 426 , by 189.
7. 325 by 147; by 273.

Multiply

8. 932 by 183 ; by 927.
9. 718 by 284 ; by 832.
10. 529 by 546 ; by 756.
11. 638 by 217 ; by 618.
12. 435 by 248 ; by 428.

584. To multiply by any number near and less than 100, 1000, etc.

585. The **Complement** of a number is the difference between the number and the unit of the next higher order.

586. RULE.—*Add to the multiplicand as many ciphers as there are ciphers in the unit next higher than the multiplier, and from the result subtract the product obtained by multiplying the multiplicand by the complement of the multiplier.*

EXAMPLES.

587. *1.* Multiply 456 by 98.

OPERATION.

45600	product	by	100.
912	"	"	2.
44688	"	"	98.

Multiply

2. 77 by 99; by 93.
3. 84 by 98; by 95.
4. 72 by 94; by 96.

Multiply

5. 387 by 93; by 999.
6. 416 by 95; by 994.
7. 528 by 93; by 992.

588. To multiply together two numbers, whose mean number may be squared mentally.

589. RULE.—*From the square of the mean number, subtract the square of the difference between the mean number and one of the given numbers.*

NOTE.—This rule depends upon the algebraic formula, $(a+b)\times(a-b) = a^2-b^2$.

EXAMPLES.

590. *1.* Multiply 37 by 43. *Ans.* 1591.

ANALYSIS.—The mean number is 40. Its square is 1600. The square of 3, the difference between the mean number and one of the numbers, is 9. 1600−9 = 1591.

Multiply mentally

2. 87 by 73.
3. 63 by 57.
4. 22 by 18.
5. 93 by 87.
6. 42 by 38.
7. 48 by 52.
8. 112 by 108.
9. 116 by 124.
10. 115 by 105.

CROSS MULTIPLICATION.

591. Cross Multiplication depends upon the following principles:

Units	multiplied by	units	produce units.
Tens	" "	units	" tens.
Units	" "	tens	
Hundreds	" "	units	" hundreds.
Tens	" "	tens	
Units	" "	hundreds	
Thousands	" "	units	" thousands.
Hundreds	" "	tens	
Tens	" "	hundreds	
Units	" "	thousands	
Ten-thousands	" "	units	" ten-thousands.
Thousands	" "	tens	
Hundreds	" "	hundreds	
Tens	" "	thousands	
Units	" "	ten-thousands	
	Etc., etc.		

Ex. Multiply 68 by 74. *Ans.* 5032.

OPERATION.

$$\begin{array}{r} 68 \\ \underline{74} \\ 5032 \end{array}$$

ANALYSIS.

$$\begin{array}{r|l} 4 \times 8 = 3 & 2 \\ 4 \times 6 + 3 \text{ (carried)} + 7 \times 8 = 8 & 3 \\ 7 \times 6 + 8 \text{ (carried)} = 5 & 0 \end{array}$$

Ex. Multiply 579 by 42. *Ans.* 24318.

OPERATION.

$$\begin{array}{r} 579 \\ \underline{42} \\ 24318 \end{array}$$

ANALYSIS.

$$\begin{array}{r|l} 2 \times 9 = 1 & 8 \\ 2 \times 7 + 1 \text{ (carried)} + 4 \times 9 = 5 & 1 \\ 2 \times 5 + 5 \text{ (carried)} + 4 \times 7 = 4 & 3 \\ 4 \times 5 + 4 \text{ (carried)} = 2 & 4 \end{array}$$

Ex. Multiply 567 by 348. *Ans.* 197316.

OPERATION.

$$\begin{array}{r} 567 \\ \underline{348} \\ 197316 \end{array}$$

ANALYSIS.

$$\begin{array}{ccccc} & & 8\times5 = 40 & 8\times6 = 48 & 8\times7 = 56 \\ & 4\times5 = 20 & 4\times6 = 24 & 4\times7 = 28 & \\ 3\times5 = 15 & 3\times6 = 18 & 3\times7 = 21 & & \\ \hline 19 & 7 & 3 & 1 & 6 \end{array}$$

592. **To multiply together numbers of two figures each whose units are alike.**

Ex. Multiply 76 by 46. *Ans.* 3496.

OPERATION.

76
46
3496

ANALYSIS.

$6 \times 6 = 3\ 6$

$\left.\begin{matrix}6 \times 7\\6 \times 4\end{matrix}\right\}\ 6 \times 11 + 3 \text{ (carried)} = 6\ 9$

$4 \times 7 + 6 \text{ (carried)} = 3\ 4$

Ex. Multiply 135 by 65. *Ans.* 8775.

OPERATION.

135
65
8775

ANALYSIS.

$5 \times 5 = 2\ 5$

$\left.\begin{matrix}5 \times 13\\5 \times 6\end{matrix}\right\}\ 5 \times 19 + 2 \text{ (carried)} = 9\ 7$

$6 \times 13 + 9 \text{ (carried)} = 8\ 7$

593. [illegible] *units by units for the first figure* [illegible] *the sum of the tens by units for the second* [illegible] *for the third figure, carrying when* [illegible]

EXAMPLES.

594. Multiply [illegible]

[illegible]

595. [illegible] multiply together numbers of two figures each whose [illegible] are alike.

Ex. [illegible] *Ans.* [illegible]

[illegible]

Ex. Multiply 127 by 122. *Ans.* 15494.

OPERATION.

$$\begin{array}{r} 127 \\ \underline{122} \\ 15494 \end{array}$$

ANALYSIS.

$$\begin{array}{rr|l} & 2 \times 7 = 1 & 4 \\ \left.\begin{array}{l} 12 \times 2 \\ 12 \times 7 \end{array}\right\} & 12 \times 9 + 1 = 10 & 9 \\ & 12 \times 12 + 10 = 15 & 4 \end{array}$$

596. RULE.—*Multiply units by units for the first figure of the product, the sum of the units by tens for the second figure, and tens by tens for the remaining figures, carrying when necessary.*

EXAMPLES.

597. Multiply

1. 87 by 82; 81 by 87; 65 by 63.
2. 47 by 44; 56 by 52; 58 by 57.
3. 73 by 76; 79 by 75; 68 by 63.
4. 44 by 43; 52 by 55; 67 by 63.
5. 116 by 117; 107 by 105; 125 by 122.

598. To multiply together two numbers whose tens are alike, and the sum of whose units is ten.

599. RULE.—*Multiply the units together for the two right-hand figures of the product, one of the tens by 1 more than itself for the remaining figures.*

EXAMPLES.

600. *1.* Multiply 76 by 74. *Ans.* 5624.

ANALYSIS.—6 × 4 = 24, the two right-hand figures of the product. 6 × 7 (6 + 1) = 42, the remaining figures.

Multiply mentally

2. 24 by 26; 85 by 85; 128 by 122.
3. 17 by 13; 94 by 96; 112 by 118.
4. 34 by 36; 37 by 33; 104 by 106.
5. 25 by 25; 43 by 47; 143 by 147.
6. 35 by 35; 56 by 54; 152 by 158.

601. To multiply by means of complements (585).

Ex. Multiply 991 by 996.

OPERATION.

$$\begin{array}{r} 991..9 \\ \underline{996..4} \\ 987036 \end{array}$$

ALGEBRAIC MULTIPLICATION.

$$\begin{array}{l} \left.\begin{array}{l} 991 = 1000 - 9 \\ 996 = 1000 - 4 \end{array}\right\} \text{sum} = 2000 - 13 \\ \hline 1000 \times 1000 - 9 \times 1000 \\ \qquad\qquad - 4 \times 1000 + 36 \\ \hline (1000 - 13) \times 1000 \qquad + 36 \end{array}$$

ANALYSIS.—From the above algebraic multiplication, it is observed: 1st, that as many of the right-hand figures as there are ciphers in the unit of comparison may be obtained by multiplying the complements together; 2nd, that the second part of the result is equivalent to the sum of the numbers less the unit of comparison multiplied by that unit.

The sum of the numbers less the unit of comparison may be obtained by adding the numbers and omitting the 1 at the left-hand, or by subtracting either complement from the opposite number. Thus, 991 − 4 = 987.

602. RULE.—*From either number subtract the complement of the other, and to the right of the remainder write the product of the complements.*

NOTES.—1. When there are less figures in the product of the complements than ciphers in the unit of comparison, write ciphers in the result to supply the deficiency.

2. When there are more figures in the product of the complements than ciphers in the unit of comparison, add the excess on the left-hand to the second part of the result.

3. After practice, the complements may be omitted in the operation.

EXAMPLES.

603. *1.* Multiply 88 by 95; 975 by 993; 9999 by 9999.

$$\begin{array}{lll} (a.) & (b.) & (c.) \\ 88..12 & 775..225 & 9999...1 \\ \underline{95...5} & \underline{993....7} & \underline{9999...1} \\ 8360 & 769575 & 99980001 \end{array}$$

Multiply

2. 97 by 99; by 94.

3. 88 by 91; by 95.

4. 89 by 93; by 96.

5. 75 by 97; by 98.

6. 92 by 98; by 93.

7. 86 by 94; by 95.

Multiply

8. 993 by 992; by 994.

9. 990 by 991; by 988.

10. 982 by 994; by 995.

11. 925 by 996; by 994.

12. 875 by 992; by 993.

13. 847 by 990; by 988.

604. To multiply together two numbers of the same number of figures over and near 100, 1000, etc.

Ex. Multiply 116 by 103.

OPERATION.

$$\begin{array}{r} \cancel{1}16 \\ \underline{103} \\ 11948 \end{array}$$

ALGEBRAIC MULTIPLICATION.

$$\begin{array}{rl} 116 = & \left.\begin{array}{l} 100 + 16 \\ 100 + \;\;3 \end{array}\right\} \text{sum} = 200 + 19 \\ 103 = & \\ \hline & 100 \times 100 + 16 \times 100 \\ & \qquad\qquad + \;\;3 \times 100 + 48 \\ \hline & (100 + 19) \times 100 \qquad + 48 \end{array}$$

605. Rule.—*From the sum of the numbers subtract the unit of comparison, and to the right of the result write the product of the excesses.*

Note.—See notes to preceding rule.

EXAMPLES.

606. *1.* Multiply 124 by 104; 128 by 106; 1015 by 1006.

$$\begin{array}{rcrcr} (a.) & \qquad & (b.) & \qquad & (c.) \\ \cancel{1}24 & & \cancel{1}28 & & \cancel{1}015 \\ \underline{104} & & \underline{106} & & \underline{1006} \\ 12896 & & 13568 & & 1021090 \end{array}$$

2. 112 by 106; by 111.
3. 102 by 103; by 104.
4. 122 by 108; by 105.
5. 116 by 107; by 112.
6. 118 by 101; by 109.
7. 145 by 107; by 112.
8. 176 by 111; by 108.
9. 1004 by 1006; by 1007.
10. 1125 by 1008; by 1012.
11. 1116 by 1015; by 1008.

607. To multiply together two numbers, one of which is more and the other less than 100, 1000, etc.

Ex. Multiply 109 by 97.

OPERATION.

$$\begin{array}{rl} \cancel{1}09 & \text{9 excess.} \\ \underline{97} & \text{3 complement.} \\ 10600 & \\ \underline{27} & \left.\begin{array}{l}\text{Product of excess} \\ \text{and complement.}\end{array}\right\} \\ 10573 & \end{array}$$

ALGEBRAIC MULTIPLICATION.

$$\begin{array}{rl} 109 = & \left.\begin{array}{l} 100 + 9 \\ 100 - 3 \end{array}\right\} 200 + 6 \\ 97 = & \\ \hline & 100 \times 100 + 9 \times 100 \\ & \qquad\qquad - 3 \times 100 - 27 \\ \hline & (100 + 6) \times 100 \qquad - 27 \end{array}$$

608. RULE.—*Multiply the sum of the numbers less the unit of comparison by that unit, and from the product subtract the product of the excess and complement.*

EXAMPLES.

609. Multiply

1. 107 by 97; by 95.
2. 112 by 96; by 92.
3. 116 by 94; by 98.
4. 108 by 91; by 99.
5. 115 by 99; by 88.

Multiply

6. 1005 by 91; by 93.
7. 1007 by 95; by 97.
8. 1012 by 99; by 92.
9. 1018 by 94; by 96.
10. 1024 by 98; by 89.

SHORT METHODS OF DIVISION.

610. Leaving out the Products.—In long division the process may be shortened by the following:

611. RULE.—*Subtract the several products from the next number greater ending with the corresponding figure in the dividend, and carry each time the left-hand figure of the minuend to the next product.*

NOTE.—If the right-hand figure of any product is the same as the corresponding figure of the dividend, subtract it from itself, and not from the next higher number ending with the same figure; or, write 0 in the remainder, carrying the left-hand figure of the product.

Ex. Divide 42343014 by 973.

```
42343014 | 973
 3423    |------
  5040   | 43518
   1751
    7784
     000
```

ANALYSIS.—The first quotient figure is 4, by which we multiply. 4 times 3 are 12, which subtracted from 14 (the next number greater ending with 4) leaves 2. Write 2 in the remainder and carry 1. 4 times 7 are 28, 1 carried makes 29, which subtracted from 33 (the next number greater ending with 3) leaves 4. Write 4 in the remainder and carry 3. 4 times 9 are 36, 3 carried makes 39, which subtracted from 42 leaves 3. Write 3 in the remainder and carry 4. 4 subtracted from 4 leaves 0. Bring down 3, the next figure of the divisor. So proceed until the division is finished.

612. To divide by 25.

613. Rule.—*Multiply the dividend by 4, and divide the product by 100 by cutting off two figures from the right.*

Ex. Divide 11175 by 25.

OPERATION.

11175
4
447.00

Analysis.—Since 25 is one-fourth of 100, multiplying by 4 and dividing by 100, is the same as dividing by 25.

EXAMPLES.

614. *1.* Divide the following numbers by 25 : 1175, 1650, 1700, 2875, 3825, 4950, 3800, 1725, 1775, 1825, 1975, 2000, 1650.

615. To divide by 125.

616. Rule.—*Multiply by 8 and divide the product by 1000 by cutting off three figures from the right.*

Ex. Divide 21875 by 125.

OPERATION.

21875
8
175.000

Analysis.—Since 125 equals 1000 divided by 8, multiplying by 8 and dividing by 1000, is the same as dividing by 125.

EXAMPLES.

617. *1.* Divide the following numbers by 125 : 13500, 17250, 16375, 23500, 19875, 17625, 20000, 14125, 19375, 16250.

618. To divide by 12½.

619. Rule.—*Multiply by 8 and divide by 100.*

620. To divide by 16⅔.

621. Rule.—*Multiply by 6 and divide by 100.*

622. To divide by 33⅓.

623. Rule.—*Multiply by 3 and divide by 100.*

EXPLANATORY NOTES.

624. The marks, numbers, abbreviations, *etc.*, of the bills in Art. **278** are explained in the following notes:

1. Bill 2, 7th item—2177 *lbs.* Sifted Meal at $1.20 per *cwt.*; 8th item—$264\frac{9}{32}$ (9 *lbs.*) bushels Oats at 56 *cts.* per bushel.

2. Bill 3, 1st item—16319 *bu.* 23 *lbs.* ($\frac{23}{60}$) wheat. Since the rate per bushel is very small, the number of pounds may be omitted in the calculations. 6th item—*M.*, 1000 bushels.

3. Bill 5, 3rd item—10 Kits (15 *lbs.* each) Extra Number 1 Mackerel at $1.80 per kit.

4. In Bills 6, 7, 8, 10, 11, and 12, the letters and numbers on the margin of the bills correspond with the distinguishing marks and numbers on the casks, barrels, kegs, boxes, cases, bales, and bags of merchandise.

5. Bill 6, 1st item—"$\mathrm{M}_{\mathrm{C}}\mathrm{P}$ #4385" is mark and number upon the cask; 1544, gross *wt.*; 134, tare or weight of cask. 5th item—$\frac{1}{4}$ foil, put up in $\frac{1}{4}$ *lb.* packages and wrapped in tin foil.

6. Bill 7. The small figures at the right of the words "bag" and "*bbl.*" are the prices of the same. 3rd item—121 *lbs.*, gross *wt.*, 21 *lbs.*, tare, 100 *lbs.*, net *wt.* 4th item—112 and 109, gross weights; 22 and 20, tare; 221, total gross weight; 42, total tare. 11th item—1st column, gross weight; 2nd column, tare. 12th item—$\frac{1}{2}$, $\frac{1}{2}$ gallon allowance for leakage.

7. In bills 8, 9, 10, and 11, the small figures represent fourths (quarters).

8. Bill 8, 1st column, number of yards in each bale or case. 2nd column, price per yard.

9. Bill 9, 1st item—2 pieces Naumkeag Bleached Jean containing 48 and 47 yards respectively; total, 95 yards at 9 cents per yard.

10. In bill 10, the numbers represent the number of yards in the several pieces.

11. Bill 11, 1st column, distinguishing number of each case. 2nd column, number of yards in the several cases.

12. Bill 12. Number on margin (1789), number of case. Numbers 3458, 2032, *etc.*, manufacturer's distinguishing numbers (stock numbers).

13. Bill 14, 3rd item—200 carriage bolts of each of the following sizes: $\frac{1}{4}$ *in.* thick × 1 *in.* long, $\frac{1}{4}$ *in.* thick × $2\frac{1}{4}$ long, $\frac{1}{4}$ *in.* thick × $5\frac{1}{4}$ long, $\frac{1}{4}$ *in.* thick × $5\frac{1}{2}$ *in.* long. The numbers 2.40, 2.55, 3.15, and 3.20 represent the prices per hundred of the several sizes. In the following items, the 1st fraction represents the thickness of the bolts, and the other numbers on the same line the lengths of the different sizes. The numbers above the lengths represent the prices per hundred.

14. Bill 15. The letters and numbers on the margin refer to the numbers of the watches. 4th item—numbers 222 and 208 refer to the style numbers (stock numbers) of the guards (chains), and the numbers above ($37\frac{5}{8}$ and 56) express the weights in pennyweights; $1.15 per pennyweight.

ANSWERS.

Art. 20.

1. 3^2, 5, 7, 11.
2. 3, 7, 11, 13.
3. 2, 3^3, 7, 11.
4. 2, 3^2, 5^2, 7.
5. 3, 5^2, 7^2.
6. 2, 3. 5, 7, 11.
7. 2^3, 3^2, 7, 13.
8. 2, 7, 13, 43.
9. 2, 3, 7, 11, 13.
10. 2^3, 11, 61.
11. 3^2, 5^2, 17.
12. 2^2, 11^3.
13. 2^{18}.
14. 3^8.
15. 5^5.
16. 2^3, 3^2, 5^2.
17. 3^2, 5, 43.
18. 3^2, 5^2, 11.
19. 2^2, 3^2, 5, 37.
20. 2^4, 3^2, 17.
21. 5^2, 11, 31.
22. 2^4, 3^3, 23.
23. 2^3, 3^2, 7, 19.
24. 5^2, 7, 29.

Art. 26.

9. 36. 13. 81.
10. 48. 14. 126.
11. 55. 15. 125.
12. 72. 16. 144.

Art. 30.

1. 29. 6. 6.
2. 37. 7. 23.
3. 31. 8. 1.
4. 43. 9. 252.
5. 47. 10. 17.

Art. 37.

8. 84. 13. 480.
9. 360. 14. 480.
10. 504. 15. 72.
16. 480. 23. 660.
17. 720. 24. 756.
18. 360. 25. 180.
19. 288. 26. 420.
20. 528. 27. 1980.
21. 1260. 28. 2520.
22. 240.

Art. 41.

1. 1. 4. 6.
2. $14\frac{3}{5}$. 5. $\frac{5}{36}$.
3. $4\frac{38}{63}$. 6. $51\frac{1}{3}$.
7. $41\frac{347}{365}$.
8. $29\frac{43}{78}$.
9. 2.
10. 1008.
11. $56.
12. $0.51.
13. $9.37½.
14. 150 bu.
15. 750 yd.
16. 133 lb.
17. $31.50.
18. 36 cows.
19. 243 bu.
20. 1290 bu.
21. $16.92.
22. $79.
23. $21.
24. 56 lbs.
25. 66.
26. 10.
27. 90.
28. $23\frac{1}{27}$.

Art. 42.

2. 3,204,084.
3. 1,042,916,880.
4. $4799.50.
5. 9,741,862.
6. $18487.
7. 251.
8. 433.
9. 4653.
10. 862.72.
11. 16098.
12. 8899.35.
13. 4745.
14. 64535.
15. 45009.
16. 27369.
17. 41976.
18. 1145760.
19. 2^2, 3^3, 7, 11, 13.
20. 92250.
21. 456.
22. 1802.
24. $458.
25. 1440.
26. 3582.
27. 132 acres.
28. 2520.
29. 2006.
30. $4.50.
31. 6.
32. $480.
33. $126.28.
34. $4664.24.
35. $46.
36. A, $12283;
B, $12568;
C, $12371;
D, $12071;
E, $12440;
D, Lowest.
37. 339 head.
38. $9292 80.
40. 3000 lbs.
41. $1044.
42. $.358;
$9.542.
43. $203.22.
44. $4,848,924.22.
45. A, $124;
B, $125.
46. $7.75.

Art. 65.

5. $\frac{9}{16}$. 18. $\frac{13}{20}$.
6. $\frac{17}{21}$. 19. $\frac{2}{3}$.
7. $\frac{2}{3}$. 20. $\frac{5}{16}$.
8. $\frac{1}{5}$. 21. $\frac{1}{11}$.
9. $\frac{3}{5}$. 24. $\frac{49}{80}$.
10. $\frac{11}{14}$. 25. $\frac{9}{16}$.
11. $\frac{7}{8}$. 26. $\frac{2}{3}$.
12. $\frac{1}{3}$. 27. $\frac{71}{198}$.
13. $\frac{54}{55}$. 28. $\frac{71}{198}$.
14. $\frac{11}{25}$. 29. $\frac{7}{8}$.
15. $\frac{3}{10}$. 30. $\frac{16}{27}$.
16. $\frac{64}{91}$. 31. $\frac{7}{8}$.
17. $\frac{81}{128}$. 32. $\frac{5}{6}$.

Art. 68.

4. $\frac{75}{105}$; $\frac{63}{105}$; $\frac{147}{105}$.
5. $\frac{164}{56}$; $\frac{35}{56}$; $\frac{28}{56}$.
6. $\frac{42}{96}$; $\frac{88}{96}$; $\frac{57}{96}$.
7. $\frac{315}{360}$; $\frac{320}{360}$; $\frac{108}{360}$.
8. $\frac{51}{72}$; $\frac{40}{72}$; $\frac{44}{72}$.
9. $\frac{48}{108}$; $\frac{80}{108}$; $\frac{153}{108}$.
10. $\frac{300}{360}$; $\frac{135}{360}$; $\frac{132}{360}$.

Art. 73.

3. $\frac{55}{60}$; $\frac{32}{60}$; $\frac{162}{60}$.
4. $\frac{42}{48}$; $\frac{104}{48}$; $\frac{27}{48}$.
5. $\frac{80}{84}$; $\frac{75}{84}$; $\frac{63}{84}$.
6. $\frac{48}{80}$; $\frac{35}{80}$; $\frac{52}{80}$.
7. $\frac{20}{35}$; $\frac{18}{35}$; $\frac{28}{35}$.
8. $\frac{69}{72}$; $\frac{64}{72}$; $\frac{68}{72}$.
9. $\frac{102}{72}$; $\frac{117}{72}$; $\frac{80}{72}$.
10. $\frac{65}{100}$; $\frac{64}{100}$; $\frac{80}{100}$.
11. $\frac{117}{144}$; $\frac{51}{144}$; $\frac{94}{144}$.
12. $\frac{110}{225}$; $\frac{147}{225}$; $\frac{144}{225}$.

Art. 76.

1. $\frac{248}{5}$.
3. $\frac{302}{3}$.
4. $\frac{151}{4}$; $\frac{159}{8}$; $\frac{3337}{16}$.
5. $\frac{170}{3}$; $\frac{292}{6}$; $\frac{1279}{7}$.
6. $\frac{751}{9}$; $\frac{249}{10}$; $\frac{373}{8}$.

7. $\frac{179}{3}$; $\frac{449}{13}$; $\frac{317}{16}$.
8. $\frac{35}{3}$; $\frac{267}{20}$; $\frac{545}{12}$.
9. $\frac{245}{3}$; $\frac{292}{3}$; $\frac{1803}{4}$.
10. $\frac{2211}{25}$; $\frac{5020}{11}$; $\frac{2145}{36}$.
11. $\frac{229}{14}$; $\frac{2877}{16}$; $\frac{7071}{4}$.
12. $\frac{292}{5}$; $\frac{5885}{12}$; $\frac{2035}{18}$.
13. $\frac{2077}{5}$; $\frac{647}{4}$; $\frac{5625}{32}$.

Art. 79.

3. 93$\frac{3}{4}$; 52.
4. 69 ; 125$\frac{1}{3}$.
5. 57$\frac{3}{5}$; 88$\frac{1}{5}$.
6. 18$\frac{15}{16}$; 35$\frac{7}{12}$.
7. 36$\frac{3}{16}$; 218$\frac{1}{4}$.
8. 321$\frac{3}{4}$; 78.
9. 49$\frac{1}{5}$; 16$\frac{17}{35}$.
10. 24$\frac{3}{16}$; 13$\frac{23}{28}$.
11. 20$\frac{11}{35}$; 15$\frac{37}{60}$.
12. 27$\frac{2}{5}$; 38$\frac{17}{35}$.
13. 24$\frac{3}{16}$; 44$\frac{1}{4}$.
14. 64$\frac{3}{8}$; 48$\frac{5}{7}$.

Art. 83.

1. 2$\frac{1}{6}$.
2. 3$\frac{1}{8}$.
3. 75$\frac{3}{16}$.
4. 143$\frac{3}{4}$.
5. 304$\frac{5}{32}$.
6. 332$\frac{17}{60}$.
7. 1105$\frac{11}{30}$.
8. 378$\frac{5}{16}$.
9. 278^2.
10. 566^2.
11. 140$\frac{9}{14}$.
12. 270$\frac{5}{28}$.
13. 1640$\frac{1}{8}$.
14. 151$\frac{131}{144}$.
15. 463$\frac{1}{70}$.
16. 229$\frac{11}{18}$.
17. 104$\frac{13}{15}$.
18. 275^2.
19. 349^1.
20. 1586$\frac{7}{16}$. .

Art. 87.

1. $\frac{7}{32}$. 5. $\frac{1}{8}$.
2. $\frac{11}{24}$. 6. $\frac{4}{35}$.
3. $\frac{5}{21}$. 7. $\frac{8}{15}$.
4. $\frac{4}{13}$. 8. $\frac{19}{55}$.
11. 88$\frac{3}{4}$.
12. 121$\frac{5}{12}$.
13. 130$\frac{11}{15}$.
14. 367$\frac{1}{8}$.
15. 458$\frac{7}{8}$.

16. 86$\frac{1}{4}$.
17. 68$\frac{1}{6}$.
18. 363$\frac{11}{18}$.
19. 138$\frac{1}{40}$.
20. 70$\frac{1}{4}$.
21. 270$\frac{3}{8}$.
22. 119$\frac{1}{12}$.
23. 389$\frac{1}{15}$.
24. 383$\frac{11}{16}$.
25. 89$\frac{11}{24}$.
26. 472$\frac{7}{16}$.
27. 88^2.
28. 126^3.
29. 299^1.
30. 121^2.

Art. 91.

1. $\$17\frac{1}{2}$.
2. 922$\frac{1}{2}$ bu.
3. $\$364$.
4. $\$368\frac{1}{2}$.
5. $\$21.22\frac{1}{2}$.
6. 3$\frac{11}{16}$.
9. 1326.
10. 1884.
11. 745$\frac{7}{8}$.
12. 440.
13. 1379$\frac{7}{8}$.
14 3364$\frac{1}{2}$.
15. 4615$\frac{1}{4}$.
16. 18024.
17. 19381$\frac{5}{8}$.
18. 5955.
19. 36706$\frac{1}{4}$.
20. 50383$\frac{1}{8}$.
21. 2391$\frac{1}{4}$.
22. 13136$\frac{3}{4}$.
23. 10158$\frac{3}{4}$.
24. 14865.
25. 77898$\frac{3}{4}$.
26. 204837$\frac{1}{2}$.
27. 252037$\frac{1}{2}$.
28. 74571.
29. 280790$\frac{3}{8}$.
30. 822887.
31. 389291$\frac{1}{2}$.
32. 79032$\frac{5}{8}$.
33. 259546$\frac{3}{8}$.
34. 183288$\frac{1}{2}$.
35. 486354$\frac{1}{8}$.
36. 340184.
37. 342468$\frac{3}{4}$.
38. 413568$\frac{3}{4}$.

Art. 95.

1. $\$2.18\frac{3}{4}$.
2. $\$11.14\frac{3}{4}$.
3. $\$36.65\frac{5}{8}$.

5. 72.
6. 30$\frac{5}{8}$.
7. 1216.
8. 1287.
9. 2010$\frac{1}{4}$.
10. 3105.
11. 9328$\frac{1}{8}$.
12. 8500.
13. 4197$\frac{1}{2}$.
14. 3091$\frac{1}{8}$.
15. 4606$\frac{1}{4}$.
16. 50570.
17. 19017$\frac{1}{4}$.
18. 53462$\frac{1}{2}$.
19. 57784$\frac{3}{8}$.
20. 70977$\frac{3}{4}$.
21. 47078$\frac{1}{8}$.

Art. 98.

6. 16. 21. $\frac{10}{21}$.
7. 3. 22. $\frac{10}{17}$.
8. 55$\frac{1}{8}$. 23. 20.
9. $\frac{1}{8}$. 24. 2$\frac{17}{30}$.
10. 12$\frac{1}{2}$. 25. 1152.
11. 11$\frac{1}{21}$. 26. 281$\frac{1}{4}$.
12. 9$\frac{1}{8}$. 27. 756.
14. 1$\frac{71}{108}$. 28. 625.
15. 1$\frac{2}{15}$. 29. $\frac{85}{144}$.
16. 3$\frac{1}{8}$. 30. 1$\frac{47}{140}$.
17. 13$\frac{1}{8}$. 31. $\frac{13}{56}$.
18. 3$\frac{1}{8}$. 32. $\frac{1}{4}$.
19. $\frac{23}{48}$. 33. 22$\frac{1}{2}$.
20. $\frac{25}{972}$. 34. $\frac{25}{216}$.

Art. 102.

7. 57$\frac{1}{2}$.
8. 145$\frac{17}{18}$.
9. 116$\frac{25}{28}$.
10. 81$\frac{1}{18}$.
11. 70$\frac{5}{8}$.
12. 72$\frac{21}{32}$.
13. 214$\frac{7}{12}$.
14. 576$\frac{1}{2}$.
15. 483$\frac{3}{7}$.
16. 703$\frac{3}{7}$.
17. 809$\frac{7}{18}$.
18. 1593$\frac{17}{36}$.
19. 2143$\frac{13}{16}$.
20. 410$\frac{1}{4}$.
21. 1329$\frac{1}{8}$.
22. 1428$\frac{9}{10}$.
23. 576$\frac{7}{18}$.
24. 194$\frac{13}{36}$.
25. 1460$\frac{7}{12}$.
26. 923$\frac{7}{48}$.
27. 472$\frac{1}{5}$.
28. 1019$\frac{1}{4}$.

29. 810$\frac{3}{8}$.
30. 396$\frac{3}{5}$.

Art. 107.

3. 37$\frac{1}{2}$. 23. 15.
4. 63. 24. 21.
5. 117$\frac{1}{3}$. 25. 10.
8. 1$\frac{1}{3}$. 26. 22$\frac{2}{7}$.
9. $\frac{11}{15}$. 27. 12$\frac{1}{2}$.
11. 6$\frac{2}{3}$. 28. 16$\frac{2}{3}$.
12. 9. 29. 18$\frac{2}{7}$.
13. 11$\frac{23}{27}$. 30. 21$\frac{1}{3}$.
14. 9. 31. 15.
15. 6$\frac{3}{55}$. 32. 9$\frac{1}{3}$.
16. 2$\frac{4}{15}$. 33. 13.
17. 2$\frac{1}{7}$. 34. 46.
18. 1$\frac{2}{7}$. 35. 18.
19. $\frac{9}{10}$. 36. 23.
20. $\frac{8}{15}$. 37. 33$\frac{1}{3}$.
21. 26$\frac{1}{4}$. 38. 18$\frac{2}{7}$.
22. 7$\frac{1}{2}$. 39. 13$\frac{1}{3}$.
40. $\frac{9}{16}$; $\frac{8}{15}$; $\frac{11}{16}$.
41. $\frac{5}{54}$; $\frac{3}{8}$; $\frac{5}{6}$.
42. $\frac{3}{4}$; $\frac{6}{7}$; 1$\frac{1}{3}$.
43. 2 ; 1$\frac{1}{2}$.
44. 2$\frac{1}{2}$; 2.
45. 635$\frac{1}{2}$; $\frac{1}{3}$.

Art. 109.

4. 7441$\frac{3}{4}$;
32612$\frac{3}{8}$;
23419$\frac{5}{8}$.
5. 7741$\frac{1}{8}$;
9031$\frac{5}{16}$;
32715$\frac{15}{32}$.
6. 3845$\frac{5}{8}$;
14100$\frac{5}{8}$;
33200$\frac{9}{16}$.
7. 7302$\frac{11}{32}$;
16233$\frac{43}{64}$;
20390$\frac{25}{64}$.
8. 21765$\frac{3}{8}$;
68722$\frac{5}{32}$;
299475$\frac{7}{16}$.
9. 39308$\frac{13}{32}$;
81386$\frac{1}{32}$;
35195$\frac{1}{64}$.

Art. 110.

1. $\frac{9}{16}$.
3. $\frac{5812}{8}$.
4. 1718$\frac{7}{8}$.
5. 193$\frac{13}{24}$.
6. 862$\frac{7}{12}$.
7. 3$\frac{1}{3}$.
8. 302356$\frac{1}{4}$.
9. 303520$\frac{1}{4}$.
10. 10.

11. 12.
12. 21.
13. $1763\frac{3}{4}$; $352\frac{3}{4}$.
14. $186.00\frac{1}{4}$.
15. $145\frac{3}{4}\frac{1}{16}$.
16. $2448.
17. $280.59.
18. $48492.
19. $95\frac{1}{3}$ bu.
20. $22.90\frac{1}{2}$.
21. $895\frac{1}{5}$.
22. A, $648 ;
B, $1080.
23. $4360\frac{75}{128}$.
24. 336.
25. $2475.
26. $\$262\frac{1}{2}$.
27. $94\frac{1}{3}$.
28. $96\frac{1}{4}$; $36\frac{1}{3}$.
29. Horse, $705 ;
Carriage,
$\$440\frac{5}{8}$.
30. $\$2003\frac{1}{9}$.
31. $157.67.
32. $50\frac{1}{2}$.
33. $9.46.
34. $123\frac{1}{16}$ gal.
35. Widow,
$2876.12 ;
Each child,
$1438.06.
36. $1403\frac{1}{3}$.
37. $192.
38. $4600.
39. Lost $\$.38\frac{3}{20}$.
40. $20191\frac{3}{4}$;
$24348\frac{7}{8}$.
41. $31963\frac{3}{8}$;
$185517\frac{5}{32}$.
42. $6224\frac{5}{8}$;
$14241\frac{3}{16}$.
43. $19479\frac{7}{8}$;
$8426\frac{11}{16}$.
44. $198.31.
45. 19744.
46. $84.24.
47. 27.80.
48. 76.66.
49. 320 rods.
50. 6 days.
51. Gained 2 cts.
52. $629.80.
53. $5487.98.
54. 110 bu.
55. $35.46.
56. $13[illegible].
57. $111
58. $316.74.
59. 319868 ;
26656.

Art. 129.

5. .4375.
6. .78125.
7. .425.
9. $.833\frac{1}{3}$.
10. $.583\frac{1}{3}$.
11. $.714285\frac{5}{7}$.
12. $.444\frac{4}{9}$.
13. 16.625.
14. $27.923076\frac{12}{13}$.
15. $36.9583\frac{1}{3}$.

Art. 132.

7. $\frac{2}{125}$. 19. $\frac{5}{48}$.
8. $\frac{16}{125}$. 20. $\frac{7}{72}$.
9. $\frac{9}{6250}$. 21. $\frac{3}{560}$.
10. $\frac{64}{125}$. 23. $\frac{1}{7}$.
11. $\frac{9}{10}$. 24. $\frac{1}{12}$.
12. $\frac{3}{16}$. 25. $28\frac{3}{80}$.
16. $\frac{5}{12}$. 26. $107\frac{1}{6}$.
27. $175\frac{12}{125}$.
28. $6\frac{7}{400}$.

Art. 135.

1. 492.319787.
2. 7462.315266.
3. 476.338080807.
4. 2.6591587.
5. 9710.278789.
6. 1.835862555.
7. 1764.06.
8. $\$776.42\frac{7}{8}$.
9. $215.2742\frac{6}{17}$.
10. $21.90267305\frac{5}{9}$.

Art. 138.

1. 3.9803.
2. .26971.
3. 8999.1.
4. .4648.
5. 16.6736.
6. .010102.
7. $86.17.
8. 2.126155.
9. $1.728\frac{1}{4}$.
10. $\$121.14\frac{1}{3}$.
11. $\$1727.93\frac{1}{3}$.
12. $.924\frac{4}{9}$.
13. $81.0458\frac{1}{3}$.
14. $58.89\frac{1}{3}$.
15. $68.04\frac{1}{11}$.
16. $59.702\frac{2}{3}$.
[illegible] $5512.83\frac{1}{3}$.
71.

Art. 141.

1. .0004128.
2. .80448.
3. .00010112.
4. $43.216 ;
f. 182.2875.
5. 45.77125 ;
$55.02291\frac{2}{3}$.
6. .273735;
1.3136.
7. 3.39924 ;
.409652.
8. .00540625;
.8455375.
9. 11.208704 ;
.0100672.
10. $5.705483\frac{1}{3}$;
$34.01345\frac{5}{8}$.
11. $28.648083\frac{1}{3}$;
21.984375.
12. .288 ; 44.0928.
13. $93.0568\frac{1}{3}$;
$4.0203\frac{1}{3}$.
14. $115.6666\frac{2}{3}$;
$500.4029\frac{1}{6}$.
15. .51153 ;
$3.8533\frac{1}{3}$.
16. $82.0166\frac{2}{3}$;
$1061.1796\frac{7}{8}$.
17. 1296 ; 576 ;
432 ; 216 ;
345.6 ; 1080.
18. 25.8480726.
19. 170845.86.
20. .00132496 ;
430.5625;
2047.5625.
21. 520.688691125.
.000669921875.
305841.443-
359 +.

Art. 144.

1. .048.
2. 250.
3. 104 ; 8.625.
4. 1.914 ; 2.82.
5. .875 ; 100.8.
6. 481.5 ; 385.2.
7. 4.25 ; 6.2.
8. 15.24706 ;
2.25.
9. .49 ; 82.6875.
10. .5694 ; 39.
11. 18.66 ;
10.80152 +.
12. 2728.08 ; 42.
13. 86.40 ; 69.12 ;
51.84 ; 138.24
25.92.
14. 1800.
15. 3720.
16. 12.
17. 2.525.
18. 293.040015.
19. $3\frac{1}{3}$.
20. $158\frac{1}{3}$.

Art. 145.

1. .1651386.
2. $289.3624\frac{20}{21}$.
3. .8125.
4. $\frac{1}{12}$.
5. $158.916\frac{2}{3}$.
6. $176.277\frac{7}{9}$.
7. $\frac{67}{80}$.
8. 863.68964.
9. 3500.
10. .04.
11. 2.
12. $117.16\frac{2}{3}$.
13. 61.875.
14. 576.
15. 5.
16. $3\frac{1}{8}$.
17. 331.20.
18. $56.16.
19. $1575.
20. $108.99.
21. $143.06.
22. 21200 bu.
23. $5567.50 ;
$4.443, wood ;
$.486, grain.
24. $1803.07.
25. $33107.12.
26. $10542.48, B ;
$7028.32, C, D
E.
27. $31444.87.
28. $203\frac{29}{80}$ Acres ;
$36\frac{39}{40}$ to B ;
$67\frac{69}{80}$ to C ;
$4575.65.
30. 7040 ft.
31. $500.
32. 275.7 tons ;
118,754 tons ;
430.7 persons.
33. 316 + tons ;
92437 tons ;
292 persons.
34. 3.07 + tons.
35. 48500, wife;
36375, son ;

24250, daugh.;
145500, total.
36. 15½ hours.
37. 0.
38. Loss, $500.
39. $1065.
40. $4.63.
41. 1100.
42. 3423$\frac{11}{14}$ miles.

Art. 196.

1. 2326 d.
2. 220 gills.
3. 108404 f.
4. 13265 lb.
5. 8784 hr.
6. 525600 m.
7. 235923 f.
8. 1566 qt.
9. 8760 hr.
10. 4480 pwt.
11. 27005 ft.
12. 2407680 ft.
14. 28675 l.
15. 2460 rd.
16. 7895¼ sq. ft.
17. 2934¼ sq. yd.
18. 3200 a.
19. 16000 a.
20. 2160 cu. ft.
21. 35942 lb.
23. 474 qt.
24. 133000 lb.
25. $345.60.
26. 6574 d.
27. 266 d.

Art. 199.

1. £35 6s. 3d.
2. 75 C. 83 cu. ft.
3. 117 bu. 2 pk.
   7 qt.
4. 38 bbl. 30 gal.
   1 pt.
6. 252 sq. rd.
   10 sq. yd.
7. 23 y. 42 d.
8. 37 wk. 6 d.
   15 hr.
9. 2 hr. 38 m.
   57s.
10. 31 rd. 2 yd.
    2 ft. 5 in.
11. £55 15s. 7d.
12. 1704 f.
14. 247 ch. 36 ft.
15. 1346 ch.
16. 255 rd.
17. 33 A. 36 sq. rd.
18. .4938 A.
19. 6 m. 25 sq. ch.
20. 48 A. 5 p.
21. £18 8s. 2d.
22. $564.29.
23. $260.54.
24. $436.95.
25. $326.88.
26. 5177⅓ ft.
27. $85.48.
28. $10.06.
30. £56 7s.

Art. 202.

1. 150 d.
2. 17s. 6d.
3. 135 d.
4. 11s. 3d.
5. 2 y. 4 m.
6. £16 9s. 4d.
7. £2053 7s. 9d.
8. 2 y. 5 m.
9. 36 cu. yd.
   3 cu. ft.
10. 3 m. 3 d.

Art. 204.

1. £$\frac{1}{384}$.
2. £.04375.
4. ⅞ oz.
5. £.003125.
6. $\frac{1}{32000}$ mi.
7. £.925.
8. .90625 cd.
9. £247.7375.
11. $\frac{5}{352}$ mi.
12. £27.525.
13. $42.65.
14. $166.56.
15. $138.01.
16. $146.56.
17. $6022.92.
18. £1 5s. 7½d.

Art. 206.

1. £85 7s. 10d.
2. 69 T. 15 cwt.
   20 lb.
3. £460 7s. 6d.
4. 12 yr. 2 mo.
   16 da.
5. 21 cd. 34 cu. ft.
6. 26 hr. 46 min.
7. 152° 4′ 2″.
8. 121.31 ch.
9. 10 lb. 2 pwt.
   20 gr.
10. 124 gal. 2 qt.
11. £205 12s. 5d.
12. £546 1s. 7d.

Art. 208.

1. £88 4s. 2d.
2. £21 4s. 4d.
3. £3 14s. 3d.
4. £23 13s. 10d.
5. 4 yr. 3 mo. 2 da.
6. 4 yr. 4 mo.
   22 da.
7. 6 mo. 10 da.
8. 2 yr. 6 mo.
   24 da.
9. 1 hr. 58 min.
   4 sec.
10. 17° 58′ 56″.
11. 17 T. 14 cwt.
    24 lb.

Art. 211.

1. 7 mo. 18 da.
2. 8 mo. 18 da.
3. 1 yr. 8 mo.
   11 da.
4. 2 yr. 5 mo. 7 da.
5. 1 yr. 10 mo.
   8 da.
6. 9 mo. 12 da.
7. 9 mo. 12 da.
8. 1 yr. 4 mo.
   15 da.
1. 230 days.
2. 263 days.
3. 619 days.
4. 888 days.
5. 678 days.
6. 286 days.
7. 286 days.
8. 504 days.

Art. 213.

1. £157 16s.;
   £192 17s. 4d.;
   £263.
2. 34 cd. 16 cu. ft.
3. £28 2s. 6d.
4. £6 7s. 10d.
   £7 5s. 9d.
5. 3 lb. 3 oz.
   12 pwt.
6. 24 hr. 35 min.
   30 sec.;
   19 hr. 40 min.
   24 sec.;
   29 hr. 30 min.
   36 sec.
7. 55 da. 13 hr.
8. £3 9s. 2d;
   £8 6s. 1d;
   £9 13s. 10d.
9. £20 12s. 6d.
10. 167 bu. 1 pk.
11. 44 mi. 6 fur.;
    71 mi. 4 fur.
    32 rd.

Art. 215.

1. £1 4s. 9d.;
   £1 10s. 3d.;
   £ 8s. 3d.
2. 192 yd.;
   324 yd.
3. £17 5s.;
   £9 11s. 8d.;
   £5 15s.
4. 44 yd.
5. 5° 41′ 14″;
   4° 44′ 21⅔″;
   3° 9′ 34$\frac{4}{9}$″.
6. £41 18s. 11d.
7. 32 A. 41 sq. rd.
   24 A. 130 sq. rd.
   20 A. 25⅝ sq. rd.
8. 99 ft.
9. 3 oz. 5⅝ pwt.
10. 9s. 11d.;
    £5 19s.;
    £9 18s. 4d.

Art. 220.

1. 73° 54′ 25″.
2. 73° 23′ 52″.
3. 34° 49′.
4. 178° 34′ 17″.
5. 88° 33′ 45″.
6. 149° 14′ 13″.
8. 54 min. 30⅘ sec.
9. 11 hr. 2 min.
   59$\frac{2}{15}$ sec.
10. 50 min. 11$\frac{7}{15}$
    sec.
11. 5 hr. 4 min.
    20⅘ sec.
12. 11 hr. 58 min.
    11$\frac{13}{15}$ sec.
14. 154° 8′ 30″ W.
15. 5 hr. 8 min.
    42 sec., P. M.
16. 19° 31′.
17. 10 hr. 54 min.
    27 sec., A. M.

Art. 226.

5. 8742.57 m.
6. 119 Km.

7. $98.70.
8. 2306.8 m.
9. 910 m.

Art. 229.

6. 400.
7. 166.4 H.
8. $12.44.
9. 40.
10. 96 H.
11. 650.

Art. 232.

3. 28 cu. m.
5. 4.81208 cu. m.
6. 2051.28 cu. m.
7. $109.69.
8. 82.5 sters; 43.2 m.

Art. 234.

3. 72 Hl.
4. 168 Hl.
6. $1498.
8. 180 bags.
9. 10080 Dl.
10. $14.

Art. 236.

2. 16.816 T.
3. 80.
4. 30.
5. 750 g.
6. $13.608.
7. 1200.
8. 62.
9. 9300 Kg.

Art. 239.

1. 246.06 yd.; 8858.25 in.
2. 9.6558 Km.
3. 259.008 H.
4. 32808.3 ft.; 6.2137 mi.
5. 828.04776 lb.
6. 204.12.
7. 26.73 grams; 27.216 grams.
8. 1762 Hl.
9. 668.9375 cu. m.
10. 1308 cu. yd.
11. 6540.48 l.
12. 291.824 sq. yd. 2626.416 sq. ft.
13. 6237 g.; 6.237 kg.

Art. 260.

1. 202; 178.
2. 1 y. 4 m. 22 d.
3. 4; 12; 4.
4. 2 y. 4 m. 15 d.
5. $69\frac{4}{9}$¢.
7. 66 ch. 20 ft.; 52512 in.
8. 99 ch.; 6534 ft.
9. 2478.96 ft. 150.24 rd.
10. $6\frac{1}{2}$ in.; $8\frac{1}{2}$ in.; $11\frac{1}{2}$ in.
11. 2999.875 sq. ft.
13. 132.183 A.
14. 1.00352 A.
16. $23\frac{3}{8}$ sq. yd.
17. $68.27.
18. $7200.
19. 990 ft.
20. $72.
21. 8 ft.
22. 240 ft.
23. 240 ft.
24. 2700 ft.
25. $81.82.
26. 16500 ft.
27. $327.78.
28. 1400.
29. 76.8 oz. av.
30. 57.6 lb. av.
31. $141.87.
32. $84.31.
33. $172.36.
34. $127.49.
35. $487^{\underline{46}}$ bu.; $237.81.
36. $237.94.
37. $229^{\underline{18}}$ bu.
38. $158.54.
39. $4.92.
40. $5.09.
41. $6.98.
42. $7.20.
43. $0.687; $0.531; $1.02; $0.935.
44. $455^{\underline{16}}$; $435^{\underline{15}}$; $506^{\underline{26}}$; 446^{4}; $511^{\underline{18}}$.
45. 90; $155^{\underline{20}}$; $143^{\underline{24}}$; $110^{\underline{20}}$; $197^{\underline{2}}$.
46. $3.091; $1.362; $1.523; $1.812.
47. $0.762; $0.741.
48. $3.889; $14.25.
49. $430.72.
50. $1634.09.
51. $808.65.
53. $0.351.
54. 162145.26 g., gold; 18016.14 g., alloy.
55. 1546875 oz., silver; 171875 oz., copper.
56. 8355 lb. 7 oz. 98.9 g.
57. $18.605; $16.957.
58. $20.672; $18.842.
59. $0.8392.
60. 40,608,021 pieces; $88,312,142.50.
61. £135 1s. 10d.
62. £49 7s.
63. £219375; $23.72; $1067588.44.
64. 40 yd.
65. £19.8375.
66. $1100.25.
67. £15 16s. 1d.
68. £10 10s.
69. 5.1813 f.
70. $3377.50.
71. 412.50 f.
72. $5712.
73. $3018.49; $7977.96.
74. 43 r. 9 a. 11 p.
75. $246.75.
76. .9 fine; $0.9969; 6.
77. 55° 48′.
78. 4 hr. 23 min. $47\frac{2}{15}$ s., P. M.
79. 160.71 bu., exact; 160 bu. app.
80. 320 Hl.
81. $4189\frac{1}{11}$ gal.
82. 165000 l.
83. 56.867 yd.
84. $0.526.
85. 46.45 sq. dm.
86. $6.889.
87. $0.528.
88. $0.055.

Art. 273.

5. $1.25.
6. 60.
7. 1.94.
8. 21.90.
9. $125.85.
10. $159.56¼.
11 $23.75.
12. $112.68.
13. $2731.25, paid over.
14. $225.
15. $832.58.
16. 2500.
17. 2400.
18. $361.60.
19. $10800.
20. $1502.40.
21. $72.
22. 495 ft.
23. £7200.
24. $200.
25. 12000.
26. $15627.50.
27. $91500.
28. $2.94.
29. 2200.
30. $65500.
31. $1612.50, A; $2700.40, B.
32. .01¼.
33. 33⅓%.
36. $2\frac{1}{12}$%.
37. 3⅛%.
39. 6¼%.
40. 2½%.
41. $1\frac{3}{7}$%.
42. 25%.
43. $\frac{3}{20}$%.
44. 73.57%; 26.43%.
45. 12½%.
46. 2325.37.
47. $564.
49. $930.
50. $444.
51. $324.
52. 6210.
53. $456.80.
54. $2555.91
55. $1392.
58. $1197.
60. $7500.
61. 22.99%.
62. 48.39%.
63. 76.19%.
64. 20.14%.
65. 23.61%.
66. £18 15s.
67. £1 12s. 5d.

[illegible]
[illegible]
[illegible]
[illegible]
[illegible] $500
[illegible]
[illegible]
1100
[illegible] miles

Art. 198.

[illegible]
20 pills
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
1100 pwt.
[illegible]
[illegible]
[illegible]
[illegible]
[illegible] sq. ft.
[illegible] sq. yd.
[illegible]

1. [illegible] A. 26 sq. rd.
[illegible]
6 m. 25 sq. ch.
18 A. 5 p.
[illegible] 2d.
$561.29.
$260.51
$436.95.
$126.88.
517½ ft.
$85.48
$10.06.
£56 7s

Art. 202.

1. 150 d.
17s. 6d.
135 d.
11s. 3d.
2 y. 1 m.
£10 0s. 1d.
£2053 7s. 9d.
8. 2 y. 5 m.
36 cu. yd.
3 cu. ft.
3 m. 3 d.

Art. 204.

[illegible]

124 gal. 2 qt.
£205 12s. 5d.
£748 1s. 7d.

Art. 208.

1. £88 4s. 2d.
2. £21 4s. 4d.
3. £3 14s. 3d.
4. £23 13s. 10d.
5. 4 yr. 3 mo. 2 da.
6. 4 yr. 4 mo. 22 da.
7. 6 mo. 10 da.
8. 2 yr. 6 mo. 24 da.
9. 1 hr. 58 min. 4 sec.
10. 17° 53′ 56″.
11. 17 T. 14 cwt. 24 lb.

Art. 211.

1. 7 mo. 18 da.
2. 8 mo. 18 da.
3. 1 yr. 8 mo. 11 da.
4. 2 yr. 5mo. 7 da.
5. 1 yr. 10 mo. 8 da.
6. 9 mo. 12 da.
7. 9 mo. 12 da.
8. 1 yr. 4 mo. 15 da.
[illegible] days.
[illegible] days.
[illegible] days.
[illegible] days.
[illegible] days.
[illegible] days.
[illegible] days.
8. [illegible] days.

[illegible]

[illegible]

7. £3 5s. 2d.
£8 6s. 1d:
£9 13s 10d.
9. £20 12s. 6d.
10. 167 bu. 1 pk.
11. 44 mi. 6 fur.; 71 mi. 4 fur. 32 rd.

Art. 215.

1. £1 4s. 9d.; £1 10s. 2d.; £ 8s. 3d.
2. 192 yd.; 324 yd.
3. £17 5s.; £9 11s. 8d.; £5 15s.
4. 44 yd.
5. 5° 41′ 14″; 4° 44′ 21$\frac{2}{3}$″; 3° 9′ 34$\frac{1}{3}$″.
6. £41 18s. 11d.
7. 32 A. 41 sq. rd.
24 A. 130 sq. rd.
20 A. 25$\frac{5}{9}$ sq. rd.
8. 99 ft.
9. 3 oz 5$\frac{5}{9}$ pwt.
10. 9s. 11d.; £5 19s.; £9 18s. 4d.

Art. 220.

1. [illegible] 54′ 25″.
2. [illegible] 52″.
[illegible] 49″.
[illegible]
[illegible] 45″.
[illegible] 13″.
[illegible] sec.
[illegible]

Art. 321.

1. 7%. 10. 6%.
2. 7%. 11. 8$\frac{1}{3}$%.
3. 6%. 12. 9%.
4. 5%. 13. 10$\frac{1}{2}$%.
5. 7%. 14. 30%.
6. 3$\frac{1}{2}$%. 15. 8%.
7. 8%. 16. 6%.
8. 4$\frac{1}{2}$%. 17. 7%.
9. 4%.

Art. 324.

1. 6 m. 6 d.
2. 1 y. 4 m. 20 d.
3. 2 y. 2 m. 2 d.
4. 2 m. 15 d.
5. 6 m. 14 d.
6. 1 y. 10 m. 22 d.
7. 4 y. 9 m. 15 d.
8. 4 y. 8 m. 24 d.
9. 9 m. 20 d.
10. 11 m. 21 d.
11. 1 y. 5 m. 15 d.
12. 1 y. 5 m. 18 d.
13. 16 y. 8 m.
14. 28 y. 6 m. 26 d.

Art. 327.

1. $12107.84.
2. $871.31.
3. $2241.
4. $7719.16.
5. $1997.87.
6. $3000.
7. $3228.33.
8. $29419.35.
9. $30612.25.
10. $31746.03.
11. $11973.33.
12. $14370.69.
13. $3436.09.

Art. 330.

1. $1234.
2. $5280.
3. $3456.
4. $375.60.
5. $12375.
6. $1728.
7. $723.01.
8. $879.54.
9. $1511.67.
10. $2309.28.
11. $3770.52.
12. $5307.72.
13. $1642.31.
14. $2138.94.
15. $5063.11.
16. $2863.86.
17. $3590.09.

Art. 334.

1. $892.86 ; $107.14.
2. $438.60 ; $61.40.
3. $547.95 ; $52.05.
4. $762.63 ; $37.37.
5. $283.35 ; $41.65.
6. $161.64 ; $13.36.
7. $595.39 ; $204.61.
8. $641.79 ; $258.21.
9. $0.68.
10. $3629.03.
11. $204.29.

Art. 335.

1. $42.32.
2. $1843.93.
3. 5%.
4. 1 y. 10 m. 28 d.
5. $1722.02.
7. 14$\frac{2}{5}$%.
8. Latter 1$\frac{1}{2}$% better.
9. Oct. 3.
10. 7%.
11. $19230.77.
12. $28.33.
13. June 11, 1874.
14. $129 ; $131.50 ; $129.70.
15. $2376.71.
16. $7.16.
17. 17$\frac{13}{32}$%.
18. $650.
19. $1483.98.
20. $89.17.
21. $606.60.
22. $5643.
23. $4298.04 ; $4342.65.
24. £199 3s. 8d.
25. £8 10s.
26. £5 8s. 4d.
27. £9 5s. 10d.
28. £2 12s. 11d.
29. £3 17s. 4d.
30. £10 9s. 8d
31. £3 4s. 8d.
32. $6200.83.
33. 58$\frac{16}{63}$%.
34. 31$\frac{11}{19}$%.
35. $86.07.
36. 1.26\frac{2}{3}$; 30$\frac{1}{3}$%.
37. $288.39.
38. $2433.90.

Art. 338.

1. $9715.20.
2. $5187.21.
3. $13648.
4. $5631.50.
5. $4051.44.
6. $1474.27.
7. $3426.67.

Art. 343.

1. $526.44 ; $506.48.
2. $45.18 ; $37.37.
3. $83.26.
4. $1909.63 ; $2104.72.
5. $1211.
6. $220.80 ; $268.51.
7. $8583.80.
8. $1811.44 ; $2564.94.
9. $2794.32 ; $7798.54.
10. $993.03.
11. $4445.17.
12. $2450.13.
13. $747.27.
14. $4172.57.
15. $405.34.
16. $13363.84.
17. $4659.94.
18. $343.90.

Art. 354.

1. $1022.
2. $911.04 ; $919.21 ; $917.46.
4. Mar. 7, 1882 ; $6022.10.
5. $431.10.
6. Aug. 21, 1881.

Art. 360.

2. $7937.33, or $7938.19.
3. Apr. 27 ; $1181.40, or $1181.65.
4. Aug. 21 ; $5196.40, or $5197.55.
5. Nov. 2 ; $2524.16, or $2524.65.
6. Oct. 7 ; $3664.71, or $3665.96.
7. Nov. 18 ; $6395.55, or $6395.96.
8. Sept. 16 ; $8135.73, or $8139.01.
9. Sept. 1 ; $4430, or $4430.96.
10. Sept. 28 ; $8204.29, or $8204.78.
11. June 29 ; $4276.08, or $4276.73
12. Nov. 30 ; $4768.85, or $4770.44.
13. May 6 ; $8899.50, or $8900.88.
14. Jan. 15 ; $4909.58, or $4910.82.
15. Feb. 2 ; $5936.20, or $5937.07.
16. June 24 ; $9812.71.
17. Oct. 11 ; $5894.25.
18. May 13 ; $5897.87.
19. Sept. 6 ; $8603.70.
20. $5949, or $5949.70.
21. Oct. 5 ; $4946.67.
22. Apr. 4 ; $3710.
23. 5$\frac{1}{2}$%.
24. $15.87.
25. $3012.09, or $3012.63.

26. Aug. 30; $3737.21, or $3738.32.
27. May 19; $1641.17, or $1641.51.
28. Apr. 15; $882.22, or $882.56.
30. $1523.62.
31. $1523.25.
32. $3081.09.

Art. 365.

1. $678.54.
2. $242.17; $148.16.
3. $1102.69; $1184.37.
4. $1327.21; $1410.94.
5. $835.74; $924.38.
6. $393.88.
7. $3073; $3363.56.
8. $517.82; $716.61.
9. $3260.23; $4539.19.
10. $2856.29; $3118.54.

Art. 369.

2. $440; $447.16.
3. $223.31; $214.37.
4. $651.97; $753.30.
5. $104.28; $133.04.

Art. 373.

2. $262.24; $161.49.
3. $1108.57; $1192.53.
4. $1324.75; $1406.47.
5. $833.87; $920.94.
6. $897.77.
7. $3067.14; $3347.31.
8. $549.89; $764.05.
9. $3260.51; $4594.82.
10. $2849.04; $3100.52.

Art. 376.

2. $244.42.
3. $1106.12.
8. $519.07.
9. $3258.45.

Art. 379.

2. $261.58.
4. $1327.61.
8. $549.51.
9. $3260.51.

Art. 388.

1. 12.
3. 160.
4. $36.
5. $50.
6. 240 lb.
7. $111.
8. $21.875.
9. $55.50.
10. 85¼ yd.
11. 396 ft.
12. £25 11s. 9d
13. $960.
14. $2410.71.
15. A, $1875.90; B, $1598.40.
16. 15.9883 : 1.
17. $179.56.
18. $98238.64.
19. 54 gal.
20. $126.
21. $3.79.
22. $137.03.
23. 6 m. 12.8 s.
24. 5 rods.
25. $153600.
26. £27 2s. 8d.
27. 2355⅜ ft.

Art. 407.

1. $93.75.
2. $68.75.
3. $441.50.
4. 80¢.
5. $3600.
6. $281.25.
7. $22.50.
8. $56.88.
9. $71.43.
10. $57.60.
11. $4880.
12. $3120.
13. $42.
14. $9000.
15. $9000.
16. 40%.
17. $16.20; $27.
18. $1440.
19. $61.25.
20. 18¼%.
21. $2.15.
22. $792.
23. M, $1761.36; P, $1409.09; T, $880.68.
24. A, $454.54; C, $568.18.
25. 2.767%.
28. $28.03.
29. $155.70.
30. $1920.14.
31. 68.63%.
32. 87¢.
33. 116.92%; 20%; 9.22%

Art. 416.

1. $8782.81.
2. $8395.94.
3. $5006.25.
4. $4358.59.
5. $8427.52.
6. $9922.37.
7. $5270.79.
8. $4287.11.
9. $3417.18.
10. $2821.96.
11. $9898.30.
12. $8406.44.
14. $1871.48.
15. $2443.86.
16. $3346.56.
17. $2227.28.
18. $8144.96.
19. $7373.16.
20. $9222.61.
21. $6431.57.
22. $9231.46.
23. $5283.96.
24. $23.29; $9340.10.
25. $2972.25.
26. $11834.
27. $7854.67.
28. ⅛% premium.
29. $3420.05.
30. $10118.89.

Art. 431.

1. $1083.94.
2. $1583.40.
4. $2407.50.
5. $3760.69.
6. $4050.03.
7. $409.34.
8. $2483.15.
9. $4076.72.
10. $3290.93.
11. $1087.98.
12. $4261.23.
13. $4593.93.
14. $2611.06.
15. $8495.46.
16. $2373.24.
18. £1225 18s. 6d.
19. 4.83¼.
20. £1864 6s. 4d.
21. $1341.32.
22. $1162.79.
23. $965.02.
24. $767.20.
25. $1631.88.
26. $1393.72.
27. $189.60.
28. $1856.07.
29. $2023.10.
30. $1538.53.
31. $2392.60.
32. $1688.75.
33. $1411.11.
34. 80318.70 fr.
35. 17949.60 fr.
36. 5.18⅜.
38. $1692.
39. $1967.24.
40. $822.96.
41. $289.54.
42. $2359.10.
43. $1543.24.
44. $3867.75.
45. $3102.24.
46. $1547.25.
47. $2061.40.
48. $2359.33.
49. 3467.73 marks.
50. 13824 marks.
51. 94⅞.
52. $2905.05.
53. $4982.62.
54. 4562 guilders.
55. 7128 guilders.
56. 40⅝.
57. 4.885.
58. $17366.99.
59. $3.60.
60. 118.4; 117.1.

61. 85.98.
62. 147.
63. 13950.75 fr.
64. £391 4s.
65. 7343.75 fl.
66. £1009 7s. 6d.
67. £512 3s. 2d.

Art. 438.

1. Oct. 10.
2. May 11.
3. Feb. 11.
4. Aug. 4.
5. June 5, 1882.
6. June 20.
7. July 18; $1694.90; $1686.16.
8. Feb. 15, 1882.
9. Oct. 6, 1881; $2403.88; $2367.55.
10. May 31; $2480.32; $2492.72.
11. July 14.
12. Nov. 15.
13. Sept. 5.
15. Oct. 26, 1882.
16. Sept. 25; $2425.16; $2437.33.
17. July 8.
18. Mar. 21, 1882.
20. Sept. 20, $3203.66; Apr. 19, $3080.31.
21. Nov. 8, 1881, $2441.73; Sept. 19, 1881, $2392.90.
22. Aug. 11, $2333.65; July 12, $2310.31; June 22, $2286.98.
23. July 15; May 23.
24. $4024.20, June 9; $3999.14, May 29.
25. Feb. 13, 1882, $1946.96; Nov. 14, 1881, $1899.85.
26. Apr. 12, 1883, $2614.03; Feb. 4, 1883, $2517.62.

Art. 446.

1. Jan. 17, 1882.
2. May 25, 1881.
3. Dec. 8, 1882.
4. May 13, 1882.
5. Sept. 6, 1882; $276.53.
6. Feb. 15, 1883; $1053.23.
7. Feb. 8, 1881.
8. Aug. 25, 1882.

Art. 450.

1. $2074.06; Aug. 28; Sept. 2; Sept. 2.
2. $5324.48; Nov. 28;
3. $2751.14; Sept. 27.
4. $12505.70; Apr. 26.
5. $4043.09; Dec. 10.

Art. 458.

1. $431.37.
2. $986.02.
3. $3361.51.
4. $1694.89.
5. $518.53.
6. $44955.75.
7. $400.91.
8. Rm. 9997.87.
9. $276.54.
10. $1053.22.
11. $1513.77; $32067.54; $1704.29; $47288.32.
12. Rm. 3869.18.
13. $52.23.
14. $856.19.
15. $622.42.
16. $4016.22.
17. Rm. 8825.99.
18. $880.36.

Art. 481.

1. $8750; $56.
2. 8%; $200.
3. $2,500,000.
4. $20,000,000; $2,000,000 · $\frac{1}{2}$%.
5. $500.
6. $61250.
7. $36,745,000.
8. $60000.
9. $23325.
10. 550 shares.
11. $240,000. $185,237.50.
12. $23100.
13. $36412.50.
14. $226675.
15. $17560.
16. $29043.75.
17. $68625.
18. $3277.50.
19. $16200. 20. 8.
21. $8230.
22. $80800.
23. $775.
24. 500 shares.
25. $8000.
26. $117645.
27. $28494.67.
28. $23544.58.
29. $325.
30. $3775: $3781.25.
31. $845,345,950; $14,290,416.50.
32. $90,448,287.86.
33. $16,327,007.50; $165,850.55.
34. $37.87; $11,140,834.83.
35. $1,564,305,200; $11,412,890.25.
36. $7,725,574.22; 41.48%.
37. $754,482; 75.6%.
38. $3,957,320, $49,466,500.
39. 8%; $468,455.
40. 100.
41. $66,000,000; $14,000,000.
42. 80.
43. 8%; 6%; 5$\frac{1}{2}$%.
44. $176; 33.
46. Latter $\frac{5}{12}$% better.
47. 7$\frac{3}{11}$%.
48. Chatham $60 greater.
49. 166$\frac{2}{3}$.
50. 160; 133$\frac{1}{3}$.
51. 6$\frac{1}{4}$%; 125; 62$\frac{1}{2}$.
52. $34137.50.
53. $2425.
54. $519.27.
55. $1128.34.
56. $1682.91.
57. $4030.29; $4030.29.
58. $475.
59. $1450.
60. $1625.
61. $1095.25.
62. Losses, $318.75; $129; $270.75.
63. $1125; $425; $25, loss; $175, loss.
65. 124.59; 128.80.
67. 4%.

Art. 487.

1. $7,690,418.82.
2. $11,615,280.
3. 3$\frac{1}{2}$ mills; $38,666.37; $11,986.57.
4. $13412.19.
5. $8693.72.
6. Rate 5.8 mills.
8. $37.49.
9. $57.85.
10. $231.39.
11. $177.52. $300.66.
12. $6557.
13. $5665.97.

Art. 499.

1. $9412; $5647.20.
2. $97.02.
3. $453,949.55.
4. $816.25.
5. $85.40.
6. $135.21.
7. $723.45.
8. $950.
9. $1267.50.
10. $116.94.
11. $915.95.
12. $1004.
13. $639.03.
14. $839.40.
15. $1623.80.
16. $183.90.

[illegible]

$225.
$1624.17
$1338.40.
$1922.5[illegible]
[illegible]
$231.[illegible]
$1358.9[illegible]
$1188.[illegible]
$1070.[illegible]
[illegible]
$2000.
[illegible]
Dr. Sundry
Debtors,
[illegible]

C. Sooner
Creditor.
$405.

Art. 518.

$1092.5[illegible]
72 [illegible]
$5700.
$702000
$3510.
$35625.
$7740.
$8400.
$8400.
$21375;
$17500.
$3,338,100
20,261
$23,944,406.30
$1,218,590.50
$1,439,851.70
$1047.54.
$427.84.
$30.31
$8026.52
127.
104.
18.56[illegible].

Art. 522.

$574.60.
$574.92.
$808.37;
$877.70
$485.14
$755.28;
$755.88.
$482.10;
$464.38.
$548.62;
$550.50.
$190.91;
$191.04.
$96.15.
$284.55;
$284.82.
$121.20;
$121.94.
$828.60;
$829.37.
$557.21;
$557.86
$524.77;
$524.99.
$705.74;
$705.94.
$636.58;
$637.45.

Art. 53[illegible].

[illegible]
$3555.67.
35.51 [illegible];
125.51 [illegible].

Art. 545.

2. 6.3027 [illegible];
$493.20.
3. $225.
4. V r. $3581.16;
C p. $3681.16;
Adj. rec. $100.
5. $4869.57
6. Ship rec.
$1888.08;
A r. $964.23;
B p. $1472.82;
C p. $496.94;
D p. $1032.55;
Adj. rec. $150.
7. C p. $1200.79;
S rec. $974.60
Adj. rec. $150;
Agent rec.
$76.19
8. G A [illegible];
S [illegible]
C $78[illegible]

AUG 30 1984